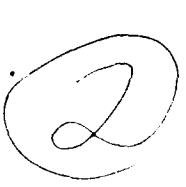


FORWARD ARMING AND REFUELING POINTS FOR MECHANIZED INFANTRY AND ARMOR UNITS

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

JARROLD M. REEVES, JR., CPT(P), USA
B.S., Presbyterian College, Clinton, South Carolina, 1982

Fort Leavenworth, Kansas
1993

REPORT DOCUMENTATION PAGE

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	4 June 1993	Master's Thesis, 1 Aug 92-5 Jun 93

4. TITLE AND SUBTITLE

Forward Arming and Refueling ~~of~~ Plats for Mechanized Infantry and Armor Units

5. FUNDING NUMBERS

6. AUTHOR(S)

CPT Jarrold M. Reeves, Jr. USA

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

U.S. Army Command and General Staff College
ATTN: ATZL-SWD-GD
Ft Leavenworth, KS 66027-6900

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This study investigates the use of Forward Arming and Refueling Points (FARP) in support of mechanized infantry and armored units. It applies the concept of aviation FARP's and maneuver units' Refuel On Move (ROM) to mechanized infantry and tank units. The concept presented is one that provides forward arming and refueling for mechanized infantry and tank battalions/task forces and companies/teams. FARPs provides a method for rapidly arming and refueling units forward of the brigade support area. The proposed FARP is organized using only current available assets. This study emphasizes the need for a method for arming and refueling units conducting offensive operations. The study explains the rationale behind the use of FARP doctrine. This study promotes the use of FARP doctrine as a sound means to rapidly arm and refuel units using currently available assets. This doctrine is necessary in providing commanders a sustainment guide for maintaining superior maneuver and firepower in offensive operations.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Forward arming and refueling points Refuel on move	97
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	

FORWARD ARMING AND REFUELING POINTS FOR MECHANIZED INFANTRY AND ARMOR UNITS

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

JARROLD M. REEVES, JR., CPT(P), USA
B.S., Presbyterian College, Clinton, South Carolina, 1982

Fort Leavenworth, Kansas
1993

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of candidate: CPT(P) Jarrold M. Reeves, Jr.

Title of Thesis: Forward Arming and Refueling Points for Mechanized Infantry and Armor units.

Approved by:

_____, Thesis Committee Chairman
LTC Dennis Barba, M.A.

_____, Member
LTC Mary Goodwin, M.A.

_____, Member, Consulting Faculty
MAJ James C. McNaughton, Ph.D.

Accepted this 4th day of June 1993 by:

_____, Director, Graduate Degree Programs
Philip J. Brookes, Ph.D.

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency.

ABSTRACT

FORWARD ARMING AND REFUELING POINTS FOR MECHANIZED INFANTRY AND ARMOR UNITS by CPT(P) Jarrold M. Reeves, Jr., USA, 94 pages.

This study investigates the use of Forward Arming and Refueling Points (FARP) in support of mechanized infantry and armored units. It applies the concepts of aviation FARPs and maneuver units' Refuel On Move (ROM) to mechanized infantry and tank units. The concept presented is one that provides forward arming and refueling for mechanized infantry and tank battalions/task forces and companies/teams.

FARPs provide a method for rapidly arming and refueling units forward of the brigade support area. The proposed FARP is organized using only current available assets within the heavy battalion. This study emphasizes the need for a method for arming and refueling units conducting offensive operations.

The study explains the rationale behind the use of FARP doctrine. It recommends a FARP doctrine as a sound means to rapidly arm and refuel units using currently available assets. This doctrine is necessary in providing commanders a sustainment guide for maintaining superior maneuver and firepower in offensive operations.

ACKNOWLEDGMENTS

I give special thanks to my thesis committee. Dr. James McNaughton, LTC Dennis Barba, and LTC Mary Goodwin who provided me with sound advice. More importantly, I appreciate their encouragement and support. Second, I owe thanks to my family, Mindy, Summer, Hannah, and Mallory. Your love, support, and understanding kept me going. Finally, again thanks for all the support from my committee and my family. Your support and encouragement provided the foundation and encouragement that provided the foundation for my determination to see it to completion.

TABLE OF CONTENTS

Page

APPROVAL PAGE..... ii

ABSTRACT iii

ACKNOWLEDGEMENTS..... iv

CHAPTER

1. INTRODUCTION..... 1

2. REVIEW OF LITERATURE 9

3. METHODOLOGY.....44

4. ANALYSIS.....49

5. NATURE OF THE FARP.....63

6. CONCLUSIONS AND RECOMMENDATIONS.....75

APPENDIX

A. GLOSSARY.....77

B. FIGURES 82

BIBLIOGRAPHY 90

INITIAL DISTRIBUTION LIST.....94

CHAPTER 1

INTRODUCTION

Whether maneuvering in the desert of Southwest Asia as a part of Operation Desert Storm, or in the National Training Center (NTC) at Fort Irwin, California, the tank or mechanized infantry fighting vehicle is the main ground force effort. The high mobility, lethality, and combat flexibility of tanks or mechanized infantry make them the main effort on today's AirLand Battlefield. During Operation Desert Storm, the tank and mechanized infantry battalions led the way in VII Corps' offensive plan. In an offensive operation, the M1 Abrams tank or the M2 Bradley Infantry Fighting Vehicle (IFV) moves continuously, and concentrates firepower quickly, to meet the needs of the maneuver commander.

To accomplish their mission, tank or mechanized infantry units require substantial amounts of fuel and ammunition pushed forward. A rapid means for rearming and refueling maneuver units must exist forward of the Brigade Support Area (BSA) if units are to maintain continuous pressure on the enemy. The Forward Arming and Refueling Point (FARP) allows the commander the flexibility to

position class III (fuel) and class V (ammunition) products forward to sustain the units.

Just as combat units must be flexible, support units must also be flexible to meet the fluid situation of the AirLand Battlefield. The FARP must be austere, transitory in nature, and responsive to the needs of specific mission objectives. The FARP should be mobile enough to self-deploy by wheeled assets or by air assets. It should be flexible enough to be configured to company, team, task force, or battalion configuration. The bottom line is that it sustains the class III and V requirements of the mission of the force.

The function of the FARP is to provide the commander with the means to rapidly resupply his unit and allow him to continue the operation. When the resupply time for class III and V activities is reduced, the commander has more time to apply continuous pressure on the enemy. As a general rule, FARPs can be employed when:

a) The tactical situation is such that a rapid means of resupplying is needed in order to maintain the offensive characteristics of speed and flexibility.

b) The unit trains cannot keep pace with their unit's rapid advance.

c) An alternative method is needed instead of the present system of unit logistical packages.

Purpose

The primary purpose of my thesis is to determine if FARP doctrine and procedures can be used to support the class III and V needs of an armored and mechanized infantry force. My thesis concentrates on the procedures used forward of the BSA by the forward support battalion (FSB) and the tank or mechanized infantry battalion support platoon.

Assumptions

Three assumptions must be made about the procedures for forward area arming and refueling operations. The first assumption is that tank or mechanized doctrine will influence the depth of battlefield. The second assumption is that motor gasoline (MOGAS) requirements in the forward area do not factor into the fueling problem. The third and most important is that there exists a need for a forward means of arming and refueling mechanized infantry and tank company teams and battalion task forces.

Definition of Terms

The terms Forward Arming and Refueling Point (FARP) and Refuel On the Move (ROM) must be defined because they form the foundation of my research question. The Aviation Branch wrote Field Manual 1-104, Forward Arming and Refueling Points, to define and explain the methodology of FARP doctrine and the operation of a FARP site. The

Quartermaster Corps wrote a section on the procedures and the equipment needed for ROM operations in Field Manual 10-71, Petroleum Tank Vehicle Operations.

Field Manual 1-104 defines a FARP as a means for arming and refueling attack helicopters in forward areas so units can maintain continuous pressure on the enemy. It is located as close to the area of operation as the tactical situation permits. Usually, it is located about eighteen to twenty-five kilometers behind the Forward Line Of Troops (FLOT). The twenty to thirty personnel from the class III (fuel) and class V (ammunition) platoon operate the arming and refueling point. The equipment to operate the point will consist of the trucks loaded with the require ammunition and the Forward Area Refueling Equipment (FARE), which connects to the fuel supply or source. The FARE consists of pumps, hoses, and nozzles which provide multiple refuel points.

ROM is a procedure for refueling combat vehicles simultaneously from a fuel supply or source such as a 5,000 gallon tanker. The location is usually dependent on the tactical situation, but it is usually between the division rear boundary and the brigade rear boundary. It can also be used to support unit movements in the offense. The Combat Service Support (CSS) units provide Petroleum, Oils, and Lubricants (POL) operators and guides. The equipment is called a ROM kit. The ROM kit consists of enough hose

connections, valves, and nozzles to operate four to twelve refuel points.

Limitations

This study is limited to applying the aviation FARP doctrine to mechanized infantry and armor unit sustainment efforts. These units have similar tactical employment and sustainment needs. All these units are employed well forward in the main battle area and defeat the enemy through firepower and maneuver. All consume large quantities of ammunition and fuel and need a steady, rapid resupply of class III and V in offensive operations. These similarities allow conclusions to be draw as to how FARP procedures can be used for mechanized infantry and armored resupply.

Another limitation is the use of unit personnel and equipment as authorized by existing Table of Organization and Equipment (TO&E). The personnel and equipment for arming and refueling exist on the TO&Es. By using these assets no additional personnel or equipment is needed. Another limitation of this study is the inability to actually setup and run a FARP. By setting up and running a FARP for mechanized infantry and tank units, human performance data could be gathered and future technological advances could be incorporated and tested. Human performance time line data could be collected for loading ammunition onto the maneuver units, uploading the weapon

systems, and refueling the maneuver elements. This study relies on past studies data and the data from Army staff planning manuals.

Delimitations

The scope of the study will focus on fuel and ammunition support in the forward area for armored carriers of a tank battalion or a mechanized infantry battalion. This study concentrates on diesel fuel or JP-8 requirements, the main fuels used by armored carriers. As the Army progresses to one fuel for the battlefield, JP-8 will replace diesel fuel as the main fuel for the armored carriers on the battlefield. MOGAS requirements are considered too minimal to significantly influence the proposed concept.

It is also limited to sustainment operations forward of the Brigade Support Area (BSA). The study addresses units involved in mid and high intensity conflict operations. The study picks up after the period of time addressed in the Combat Systems Rearm/Refuel in Battalion (COSRRIB) study which addressed from 1976 through 1980. The COSRRIB study and the time period studied provides a foundation and starting point for this study.

Significance of the Study

Maneuver commanders and logisticians need to evaluate lessons learned from Operation Desert Storm, the

National Training Center and their own field training exercises in order to develop a procedure for forward area arming and refueling. By developing and implementing such a procedure, units could better facilitate these two critical sustainment functions. This procedure could provide the guidance and foundation for the development of doctrine and/or a Tactics, Techniques, and Procedures (TTP). Commanders and their support personnel could use this improved sustainment doctrine or TTP for future operations.

Commanders of mechanized infantry and armored units would then have additional agility and initiative with a rapid forward arming and refueling procedure. Today's armor and mechanized infantry battalions use almost 21,000 gallons of fuel a day and 15 short tons (STONs) of ammunition to sustain offensive operations. A procedure for a responsive means of rearming and refueling ground maneuver forces would provide the commander with the agility and initiative to continue offensive operations.

FARP operations could provide that responsiveness and more. FARP procedures could lead to changes in basic load configurations, ammunition resupply procedures, and the number or skill of the personnel assigned to handle fuel and ammunition. Establishing a simple, rapid means to sustain units forward could reduce the quantity of fuel and ammunition in a unit or vehicle's basic load. Ammunition resupply procedures forward of the brigade support area have

never really been refined. Utilizing this procedure could free up transportation and personnel for other sustainment missions. This procedure could help establish the necessary personnel and equipment needed to rapidly rearm and refuel forward. This would lead to restructuring TO&Es and possibly reducing personnel and equipment requirements.

CHAPTER 2

REVIEW OF LITERATURE

This chapter reviews the literature on forward area rearming and refueling. Along with the review of literature, it provides basic information on forward area rearming and refueling. This will enable the reader to easily grasp the ideas and concepts which exist in this field of sustainment. The review of literature chapter also serves as the foundation of information used to compile this study.

The reader should also understand that the Army's doctrine has changed. It went from defensive in nature to offensive with the Army's adoption of AirLand Battle doctrine. FM 100-5, Operations, states that AirLand Battle doctrine "is based on securing or retaining the initiative and exercising it aggressively to accomplish the mission."[1] Sustaining AirLand Battle doctrine means we must provide fuel and ammunition in a timely manner in order to maintain the initiative and accomplish the mission. A rapid means of rearming and refueling would provide this vital sustainment to the armor and mechanized infantry units. The Aviation Branch recognized the need

and developed the FARP doctrine in Field Manual 1-104, Forward Arming and Refueling Points, in 1985.

Historical Perspective

Sustaining the ammunition and fuel needs of mechanized and armor forces has been a monumental challenge to logisticians since General Patton's Third Army crisscrossed Europe in pursuit of the retreating Germany Armies.[2] His Third Army used over 350,000 gallons of fuel and over 336 short tons of ammunition every day. Support of his pursuit provides some lessons for our sustainers and commanders of today.

For Patton to maintain the initiative he needed a rapid means of arming and refueling his forces. This was because Third Army was immobilized less from a lack of class III and V supplies than from an inability to distribute it. Supplying fuel by the five-gallon fuel can was a process too slow to rapidly refuel forward. Also, units had the problem of keeping accountability of the cans to refill them for resupply. As the lines of communication grew, Third Army kept its ammunition uploaded on trucks, creating rolling ammunition supply points. This procedure allowed for fast, forward rearming.

During the Vietnam War with the heavy reliance on helicopters, a need came for rapidly rearming and refueling them. Recognizing this need, the U.S. Army Logistics

Center, Fort Lee, Virginia; the Modern Army Select Systems Test, Evaluation, and Review, Fort Hood, Texas; and the U. S. Army Materiel Command, Washington D. C.; began work on innovative ways to simultaneously hot rearm and refuel helicopters. The plan of action was called Forward Area Rearming and Refueling Points (FARRP); and it reduced the time needed to rearm and refuel from 60 minutes to 15 minutes. The new refuel procedures led to several other studies covering all aspects of forward area arming and refueling such as:

(1) who should establish, operate, and resupply such a point,

(2) how should it be deployed, and

(3) how should it be equipped?

The culmination of the original plan of action was the development of the Forward Arming and Refueling Point Doctrine explained in FM 1-104, Forward Arming and Refueling Points, published in 1985.

After the Vietnam War, the military focus returned to the Soviet Union and the containment of Communism and the Soviet Army. Our emphasis shifted to the defense of Europe through our "How to Fight" doctrine of Active Defense operations and a build up of armored and mechanized infantry units in Europe. Active Defense operations and the heavy units required a large amount of class III and

class V to defend against the Soviet Army's armored and mechanized infantry units.

The Army recognized the requirement to sustain a large amount of ammunition and fuel. They conducted studies to improve forward area rearming and refueling in armor and mechanized units. The primary study done at the battalion level was the Combat System Rearm/Refuel in Battalions Study (COSRRIB) completed in March, 1976. The COSRRIB abstract stated "This study was designed to develop a support concept that will optimize rearming and refueling of the principal weapons systems of Army ground units conducting Active Defense operations under the 'How to Fight' tactical doctrine."[3] Its conclusion stated a need for establishing forward area rearming and refueling points using a service station type operation. These service station type operations should be located forward with the battalion or task force and use their vehicles.[4]

In 1982, the Army published its new manual, Field Manual 100-5, Operations, which outlined a new doctrine of AirLand Battle. Our new doctrinal focus shifted from defensive to offensive in nature. It is based on securing or retaining the initiative and exercising it aggressively to accomplish the mission. To execute the AirLand Battle doctrine, the Army improved its key ground combat unit's weaponry and incorporated helicopters into the scheme of battle. This made the battlefield three-dimensional. The

improved weapons - the M1 Abrams tank, M2 Bradley infantry fighting vehicle, and Cobra attack helicopter - use larger quantities of fuel and ammunition.

Background Literature

The Aviation Branch and Quartermaster Corps have conducted extensive tests and evaluations on forward area arming and refueling and refueling on the move. The Aviation Branch's research led to the publishing in 1985 of Field Manual 1-104, Forward Arming and Refueling Points. This manual establishes the doctrine for aviation's Forward Arming and Refueling Points (FARP). Aviation commanders use this manual as their doctrine for conducting responsive sustainment of fuel and ammunition in continuous attack helicopter operations.

The Quartermaster Branch's research led to a change to Field Manual 10-71, Petroleum Tank Vehicle Operations, published in 1990. This change established a procedure and equipment for units to Refuel on the Move (ROM). The procedures and equipment kit allow units to dispense fuel into four to eight combat vehicles and combat refuelers simultaneously.

Other sources of research are from the Center for Army Lessons Learned, combat development directorates, professional circulars, and studies by test and evaluation labs. The Center for Army Lessons Learned provided

information from past REFORGERs, National Training Center rotations, and other training exercises involving armored or mechanized infantry forces. Another source of research was the combat development directorates and historians of the Infantry Branch, Armor Branch, and Quartermaster Corps for any past, present, and future studies. A review of professional circulars dating from 1973 resulted in Aviation articles on FARP operations and Field Artillery and Armor articles on rearming and refueling. Test and evaluation labs provided several past studies to draw conclusions from.

ROM Studies and Doctrine

(see figure 1, ROM Diagram)

Refueling forward became an issue with the introduction of mechanized forces and aircraft into the art of war. These vehicles and operational concepts required a steady supply of fuel to maintain the initiative or momentum. Forward area refueling procedures had to be developed.

Procedures and equipment for forward refueling operations were developed. Forward refueling procedures could generally be broken down into two major categories of refueling in position and the service station method. Equipment for forward area refueling slowly evolved from

five-gallon cans to pumps and hoses connected to a 5,000 gallon tanker.

During World War II and the Korean War, 2 1/2 ton trucks and trailers delivered fuel forward to mechanized elements in position by five gallon cans. Armored units during the Korean War frequently refueled forward from 55-gallon drums. These procedures provided a rapid means of supplying fuel forward to the vehicles, and units could maintain maximum combat posture during refueling. The disadvantage was the exposure of the unprotected resupply vehicles in the battle positions and the manpower required to handle the cans or drums.[5]

During the Vietnam era and to the present, refueling operations have employed bulk fuel container vehicles for refueling. These bulk fuel containers, introduced in the mid to late 1970s, consisted of the 2,500 gallon GOER vehicle and/or two 600 gallon tanks with a pump unit mounted on the back of a 5-ton truck. These vehicles could refuel vehicles in position or could set up a service station operation for units to move through to refuel. This method solved the problem of handling the cans or drums, but units still had to deal with unprotected resupply vehicle being exposed.

Different from the two previous wars, the Vietnam era brought about the advent of the helicopter as an effective combat support vehicle. This resulted in the

rapid expansion of airmobile operations into war. This new operational concept required procedures and equipment for refueling aircraft and ground vehicles in extreme forward areas. From this need the Army recommended the development of the Air Mobile Aircraft Refueling System (AMARS). The approval of the recommendation resulted in the requirement for the development of the concept and equipment for the AMARS.

The initial AMARS equipment and operational concept called for the conversion of UH-1, CH-47, and CV-2 aircraft into "bladder birds" or bulk fuel carriers. In 1965, these bulk fuel carriers were shipped to South Vietnam for operational evaluation. Concurrently, AMARS underwent engineering and service test in the United States. These test and evaluation programs revealed many problems with the initial AMARS design.[6]

Due to the many problems that resulted from the test and evaluations of these bulk fuel carriers, the concept of Forward Area Refueling Equipment (FARE) was developed. The concept of the FARE called for an air transportable set of equipment, which could be quickly emplaced to dispense fuel from a prepositioned bulk fuel source. The need for this type of equipment had been demonstrated by the evaluation of AMARS in South Vietnam. Continued test and evaluation of FARE determined it met the requirements for AMARS.[7]

The FARE consisted of a pump, hoses, and nozzles capable of pumping fuel through one or two nozzles simultaneously. Fuel for the FARE would come from any available bulk fuel source. Its intended purpose was to primarily refuel helicopters in forward area operations. However, it could also provide a means for safe, rapid refueling of all Army aircraft, ground vehicles, and other equipment.

The FARE equipment could not be used to convert aircraft to bulk fuel carriers. Due to the shortage of aircraft, combat units were reluctant to convert them and utilize them as bulk fuel carriers. Additionally, units expressed a preference for carrying fuel tanks as external sling loads rather than internal to the aircraft.

The FARE concept and equipment provided the foundation on which the Refuel on the Move (ROM) concept was developed for the mechanized forces. ROM expanded the FARE capability by providing a means to establish more refueling points and dispense fuel from any size bulk fuel carrier up to and including a 5,000 gallon tank semitrailer.

ROM is the procedure for dispensing fuel from a 5,000 gallon tank semitrailer into four to eight combat vehicles simultaneously. The ROM kit has enough hoses, connections, valves, and nozzles to transform the 5,000 gallon tank semitrailer into a four to eight point

dispensing station. The pump assembly is self-contained on the semitrailer. ROM procedures help ensure that all combat vehicle and fuel servicing vehicle fuel tanks can be rapidly refueled forward.

ROM procedures are becoming Standard Operating Procedures (SOP) for maneuver units. Most units have established SOPs for using ROM procedures for administrative and tactical moves involving wheeled and track vehicles. During Operation Desert Storm, ROM procedures were used extensively to refuel wheeled and track vehicles. At the National Training Center (NTC), ROM operations are a required, evaluated task.

Ammunition Distribution Doctrine

Ever since the first tank was introduced in World War I, ammunition has been resupplied in the forward area all the way to the vehicles. The tanks would remain in place while the truck hauling the ammunition would pull alongside. The truck would drop the tailgate and then transload the ammunition onto the tank. The truck would then drive up to the next tank's position and again drop the tailgate and transload what ammunition that tank needed. This process was very slow and required trucks to transit the same terrain that the tank had.

From World War I to today, resupplying combat vehicles with ammunition in position has been considered

acceptable or SOP. Considering the location of tanks or mechanized infantry vehicles to the enemy weapons on the front, the trucks are exposed to direct enemy fire when arming them in position. Also, valuable transportation assets are tied up in this time-consuming process. Not only is the resupply vehicle being tied up in forward rearming operations, but the distance that these vehicles had to travel to pick up ammunition was excessive. It exceeded transportation's doctrinal line haul distance of 90 miles a day.

The principal method of ammunition resupply of a task force or battalion is supply point distribution. This method requires the task force or battalion trucks to travel back to the ammunition supply points (ASP) or to the ammunition transfer point (ATP) to draw its ammunition. These trucks then return to the units trains location and remain uploaded. The ammunition may be called forward or transloaded on to another vehicle for delivery to a consuming unit. The supply point method has two problem areas: the distance a vehicle has to drive for ammunition and the configuration the ammunition arrives in is the same configuration that it was shipped in from the wholesale point.

Another method, rearming in position, is a very difficult and time-consuming operation. Both the M1 Abrams tank and the M2 Bradley infantry fighting vehicle cannot

engage targets and upload ammunition at the same time. The turret on a tank must be traversed to different angles to stow main gun ammunition. The turret on the Bradley main gun must be traversed to a certain angle to load the belt feed ammunition in the ready box, and the rest is stored through out the vehicle. Consequently, rearming in position should not be done on a routine basis.

The service station method is the preferred method. This is accomplished by using the existing truck assets in the support platoon as a mobile ASP or ATP. The vehicles are driven forward to a designated point and the units needing ammunition drive through and are rearmed.

FARP Studies and Doctrine

The Vietnam War and its heavy reliance on helicopters led to the FARE study.[8] Ultimately, the study caused the research and development of forward area refueling equipment. The FARE not only provided the equipment for the forward area refueling point for helicopters, but also for ground equipment.

In 1971, the Air Cavalry Combat Brigade (ACCB I) Test determined that refueling and rearming are essential to effective tactical operations. The study also determined that to sustain operations the rearming and refueling of units must be done within 15 kilometers of the

line of contact. It examined the procedures, equipment, and organization.[9]

Techniques, equipment, and organization used in ACCB I did not accomplish rearming and refueling within the time limits for continual combat operations. The study also concluded that the personnel and equipment available by the Table of Organization and Equipment (TO&E) did not provide adequate resources to accomplish the mission. These shortfalls were noted: a need for multi-point refueling, reconfiguring ammunition loads, and a TO&E for Forward Area Rearming and Refueling Points. Before these shortfalls could be addressed the issue of rearming and refueling simultaneously had to be accepted. Commanders had to evaluate the safety concerns and determine the risk. Realizing the minimum risk, commanders must train in peacetime as they would in wartime.

The issue of simultaneous rearming and refueling was accepted and these problems and shortfalls were addressed in a subsequent study called Air Cavalry Combat Brigade II (ACCB II). ACCB II redesigned the refueling equipment to allow for multi-point refueling and reconfigured ammunition loads for improving rearming. These changes accomplished the operation design of simultaneously refueling and rearming five aircraft. The results of ACCB II provided a basis for further studies and test and evaluation of

equipment, techniques, and procedures to be used in FARP operations.

One study initiated in 1977 was the Human Engineering Laboratory Aviation Supply Class III/V Material (HELAVS III/V) Field Test. The study's objective was to obtain human performance data. It addressed the effects of crew size, day/night operations, and chemical/biological protective equipment on rearming and refueling. Another objective was to measure staffing levels under Division 86 Tables of Organization and Equipment (TOE). The study concluded that crew size, day/night operations, and chemical/biological equipment did have significant impact on prolonging the operations. At this point the study dealt with rearming and refueling procedures for only helicopters forward.

In 1976, the Combat Systems Rearm/Refuel in Battalions study broke ground for the study of rearming and refueling the principal weapons systems of Army ground combat units.

Combat Systems Rearm/Refuel In Battalions (COSRRIB) Study

In March 1976, the Training and Doctrine Command directed the Logistics Center at Fort Lee to conduct a study to develop a support concept that would optimize the rearming and refueling of the principal weapon systems of the Army's heavy ground combat units. The study focused

on units conducting the Active Defense under the "How to Fight" tactical doctrine. The study also focused on tank and mechanized infantry task forces and company teams and self-propelled, direct support artillery battalions operations. These units operated in the covering force area and the main battle area. The COSRRIB study examined the organizations, doctrine, and equipment of these units. It proposed conceptual changes which could be developed, refined and written into doctrinal media and tables of organization and equipment (TO&E).

The study made several valid conclusions. These recommendations covered both arming and refueling. Some have been developed, refined, and written into today's doctrine. Some of the conclusions have been adopted into today's doctrine and TO&Es.

The rearming conclusions also covered all aspects of rearming of a battalion task force and company teams. The conclusions were:

1. that the doctrine for resupply of class V should stress the establishment of forward mobile ASPs utilizing the battalion and task force basic load vehicles,

2. that there existed a valid requirement for an armored vehicle and recommended the M113 as the best available and capable,

3. that the need for additional ammunition handlers and 5-ton trucks and trailers existed,

4. that there was a need for continued research and development effort by the U.S. Army Materiel Command's Armament Command on ammunition packaging, storing, and shipping. By implementing these conclusions rearming procedures would be optimized at the weapons system forward location.

The refueling conclusions covered all aspects of refueling battalion task forces and company teams. The refueling conclusions were:

1. that refueling of weapon systems from bulk container vehicles could best be accomplished by the service station method.

2. that the FARE or ROM kit provided units with multi-point refueling from a bulk container that can be used with the service station method.

3. that refueling doctrine for the active defense was sound, but establishment of forward refueling points must be emphasized.

4. that there was not a full-time requirement for armored refueling capability in the forward areas.[10]

Current Tactical and Sustainment Doctrine

To better understand the need for forward arming and refueling, you must first understand our current doctrine. The Army's current tactical doctrine is offensive in nature. To support the doctrine the Army has identified

six key sustainment functions. Arming and fueling constitute two of these functions.

Offensive Tactical Doctrine

According to FM 100-5, Operations,

> The offensive is the decisive form of war--the commander's ultimate means of imposing his will upon the enemy. Defeat of an enemy force at any level will sooner or later require shifting to the offensive. Even in the defense itself, seizure and retention of the initiative will require offensive operations. The more fluid the battle, the more true this will be.[11]

> Offensive operation are undertaken to Defeat enemy forces Secure key or decisive terrain Deprive the enemy of resources Gain information Deceive and divert the enemy Hold the enemy in position Disrupt an enemy attack.[12]

Offensive operations under AirLand Battle doctrine seek to quickly seize the initiative. To achieve this initiative, offensive operations have certain characteristics which make them successful. These characteristics are surprise, concentration, speed, flexibility, and audacity. Through these characteristics, a commander can select the time and place to concentrate and synchronize his combat elements to overcome the enemy's defense; to destroy his command, control, and communications systems; and to defeat him in detail.[13]

Combat Service Support (CSS) provides the commander with the momentum to maintain and conduct successful offensive operations. CSS also provides commanders with the flexibility to maneuver or to mass fires and the

capacity to prolong offensive operations. Successful operations are dependent on CSS to prevent the enemy from recovering and gaining the initiative, and mounting a counter attack. CSS must have a sustainment doctrine that provides the commander with the class III and class V to maintain successful offensive operations.

Class III (Bulk Fuel) and Class V (Ammunition)

Sustainment Doctrine

Positioning of essential CSS assets such as ammunition and fuel well forward, ensures successful offensive operations. Battalions position supplies by two methods. One method is to centralize all support in one location called unit trains. Unit trains provide ease in coordination and control and security. The normal method is to echelon the support into company combat trains, battalion combat trains, and battalion field trains. Company combat trains are located just to the rear of the companies. Battalion combat trains are located close enough to the forward line of troops (FLOT) to be responsive to the forward units or companies. They are out of direct-fire range of the enemy's weapons. The battalion field trains are located in the brigade support area.

All uploaded class III and class V is located in the battalion combat trains. Here the uploaded ammunition and fuel can expect to move frequently to remain in supporting

distance of the combat elements. By having the ammunition and fuel basic loads far forward, the battalion and companies can be replenished in a timely manner.

Offensive operations increase fuel consumption, thus requiring rapid resupply to maintain the initiative. Also, offensive operations are fast moving and can result in increasing the distance between the ammunition supply points and ammunition transfer points. By positioning the uploaded ammunition and fuel in the battalion combat trains, the trains provide some form of forward arming and refueling.

Class III (Bulk Fuel) Sustainment Function

(see figure 2, Diagram Fuel Supply)

In offensive operations, victory may depend on the ability of the sustainment system to increase the flow of fuel and forward supply fuel. The armor and infantry battalions of today allow for great mobility, but they also consume large quantities of fuel. Today it is estimated that one armored division equipped with M1 tanks will consume over 600,000 gallons of fuel per day, more than twice the consumption of Patton's entire army.[15] So how is all this fuel supplied to the maneuver battalions?

The FSB receives its bulk fuel directly from the corps or from the Main Support Battalion (MSB). The forward support battalion's (FSB) support operations

officer coordinates the deliveries of class III from the corps or the MSB. The delivered fuel is transferred from the corps or MSB 5,000 gallon semitrailer tanker into the FSB's 5,000 gallon semitrailer tanker. Coordination can be made for truck drivers to drop the full semitrailer in exchange for the empty one.

Fuel is provided to the armor and mechanized infantry battalions by supply point distribution. The units supported by the FSB coordinate for their organic vehicles to be refueled at a designated supply point. The support platoon's heavy expanded mobility tactical trucks (HEMTTs) and cargo trucks mounted with tank and pump unit (TPU) refuel in the Brigade Support Area (BSA) at the class III supply point. These vehicles return to the unit trains or the combat trains location.

The battalions resupply the companies with class III by sending the HEMTTs or TPUs out as part of a logistics packages (LOGPACs) to the companies. LOGPACS are organized in the field trains by the HHC commander and the support platoon leader. The support platoon leader leads the LOGPACs forward along a main supply route (MSR) in a march unit to the logistics rallying point (LRP). At the LRP, the first sergeant or unit guide takes control and conducts resupply of the company (See LOGPAC Diagram). Once the company has been resupplied, the supply sergeant bring the vehicles, to include the HEMTT or TPU, back to the field

trains usually located nears or in brigade support area. The vehicles are refueled and go forward to the battalion combat trains or stay in the unit trains.[16]

The petroleum section of the FSB can also set up a mobile service station along an MSR. It consists of a TPU and a trailer set up to issue small quantities of diesel and MOGAS. Units can get small quantities and fill up five-gallon cans at this location.

The FSB can also set up a tactical refueling point (see figure 3) forward to ensure combat vehicles deploy to the battle with a full tank. One technique uses the FSB's 5,000 gallon tankers along with the maneuver unit's HEMTTs or TPUs. One tanker is deployed with two HEMTTs or TPUs, and it can refuel four combat vehicles at a time. If the tankers are available and the tactical situation permits, up to six sites can be set up. These refuel sites can be set up along MSRs in a single location or in split sites to stagger march elements and reduce traffic congestion. Site selection and security is the responsibility of the maneuver unit. The battalion S-4 coordinates the site and the fuel requirement with the FSB. Sometimes the corps or MSB tankers could be used to top off the FSB tankers at these sites. The primary benefit of this tactical refueling site is speed.

Class V (Ammunition) Sustainment Function

(see figure 4, Class V Supply Diagram)

Today's weapons systems consume large amounts of ammunitions at differing rates of fire. From recent wars and combat training center lessons learned, replenishing ammunition required different methods of supply. Additionally, the large variety of weapons and ammunition in use and the expected fluid battle, arming the soldier has become an even greater challenge. In periods of intense combat, arming the fighting units will be the largest, most time-intensive task of the sustainment system.[17]

To accomplish the rearming of battalions, the FSB class V section operates one ammunition transfer point (ATP) in the BSA. The ammunition transloaded at the ATP is in combat configured loads (CCL) as much as possible. CCLs are predetermined ammunition packs based on mission requirement which make up 90 to 95 percent of the major user requirements. Requirements are expressed in the type and number of CCLs and any additional single line items required by the battalion. The corps storage area (CSA) configures the CCL. Then the corps ships it forward by its organic transportation assets to the ammunition storage point (ASP) or the corps ATP in the division support area (DSA) and ATP in the BSA. Single line items, non-CCL, are sent to the ASP. The BSA receives 75 percent of its

ammunition from the CSA and the other 25 percent from the ASP.

The battalions receives its high-density ammunition from the ATP as CCLs. Maneuver battalion/brigade S4s may submit proposed CCL configurations to the Division Ammunition Officer based on their type unit, task force, or weapon system. Division and corps reviews the requested CCLs and establishes a set of standard CCLs to support the maneuver units of the corps. These standard CCLs simplify planning and coordination of ammunition resupply.[18]

Corps delivers these standard CCLs and single item ammunition loads to the ATPs by trailer. They also replenish these class V loads by trailer to the ATP. The ATP is a trailer transfer point where drivers deliver a loaded trailer and remove an empty trailer. This is done almost four times a day.

The brigade S-4 coordinates with the FSB to set up schedules to draw their CCLs and single item ammunition. The supported unit requests its ammunition through the battalion S-4. The battalion's support platoon vehicles are sent to the BSA ATP to pick up the ammunition. The ammunition is transloaded from the loaded trailers to the support platoon vehicles using material handling equipment. If the unit's requested CCL was approved, then the loadplan or configuration for each HEMTT or truck is simply. The support platoon vehicles then return to the

unit trains or go forward to the battalion combat trains. From the trains, they are sent forward to the units as part of the LOGPACs.

The Armor School realized the need to train in the area of forward logistical operations. In April, 1984, the United States Armor School at Fort Knox, Kentucky, published Field Circular 71-1, Logistical Situational Training Exercises, providing a systematic method for training units in the techniques of combat service support. It provided a way to train logistical assets.

FM 71-2 and FC 71-1 mention three other types of resupply forward. The first one is to resupply from the combat trains which consider emergency resupply. The battalion S-4 maintains a limited amount of class III and class V and resupplies units from the combat trains. This method ties up valuable transportation assets. It also limits planning and forecasting. The second method is to pre-stock by placing and concealing supplies on the battlefield. This method is normally done in the defense when you can forecast your defensive positions. In the offense, you could not pre-stock ammunition forward of your position. The third method is mobile pre-stock where supplies are pre-stocked forward but are kept mobile by keeping the supplies uploaded on trucks or trailers. Again, you are tying up your transportation assets.

The different methods of resupply and the perceived need for a logistical situational training exercises circular point to the fact that units need a responsive means to resupply forwards. The battlefield of today requires a responsive means of providing ammunition and fuel in the forward areas. Forward arming and refueling points would provide a means to sustain the battlefield. These forward points can be established using existing MTO&E personnel, equipment, and transportation assets. By establishing the organization and procedures to conduct FARPs, the commander is provided additional flexibility for maneuvering his force on the battlefield.

Analysis of Doctrine, Capabilities, and Requirements

In the COSRRIB study, fueling was not as significant a problem when compared to rearm requirements. One discovery that was surprising was that refueling could be accomplished every other day in many instances. While rearming was required more often, sometimes a unit would go through two or three basic loads before refueling.[19]

An analysis of today's technology and doctrine points out a change. Today's units have a requirement for fuel replenishment more often then ammunition. They need to refuel two or three times before they need ammunition replenishment. Desert Storm was an example of this. VII Corps Assist Chief of Staff, G4, Colonel Wilson Rutherford

wrote an article that was published in March 1993's Military Review which discussed that VII Corps logistics support exceeded class III planning data, while much of the ammunition was not used.[20]

The changes in doctrine and technology can account for this reversal. The changes in doctrine from the active defense to the offensive spirit of the AirLand Battle requires more maneuver and thus more fuel consumption. The improvements in armored carriers from the M113 to the M2 and the M60 to the M1 have greatly increased the fuel consumption of the tank and mechanized infantry battalions. The main weapon system on the M2 and M1 are more accurate and lethal than the weapon systems on the M113 personnel carrier and the M60 tank. Also the ammunition is more accurate and lethal. These factors combined show that rapid refueling is needed more often then ammunition replenishment for today's mission success.

Lessons Learned From the National Training Center

In 1982 at Fort Irwin, California, combined arms training for mechanized units began at the National Training Center (NTC). The center trained units on the new doctrine of AirLand Battle. The training focused on providing realistic multi-echeloned tactical and logistical training for combat and support units against a Soviet force. By reviewing the lessons learned from units who

have trained at the NTC, we can establish a framework to understand a need to indoctrinate or standardize forward area arming and refueling procedures.

The NTC has recognized the importance of forward area arming and refueling. Tank and mechanized infantry task forces are required to plan and execute ROM operations and forward area arming. These units receive feedback on their planning and execution of these operation through after-action reviews (AARs) and lessons learned write ups.

Based on an analysis of two heavy battalion task forces rotations and a thesis on lessons learned at NTC, the battalions going through an NTC rotations primarily resupply by using LOGPACS. Ammunition and fuel comprise the majority of the resupply needs of the company/teams. These LOGPACs are pushed forward once a day. They rely on the company or teams reports and request to configure the what supplies and what quantities to push forward.

Throughout the rotations, resupply by LOGPACs presented several recurring deficiencies. The LOGPACs did not always provide responsive and timely resupply to the units. LOGPACs tied up valuable transportation assets for extended periods of time while units resupplied. The quantities of supplies in the LOGPACs were not always tailored to the unit's needs.

The first reoccurring deficiency noted of LOGPACs was how and when they were organized and coordinated for

delivery at a certain time each day. If units needed supplies outside the predetermined window they had to rely on emergency resupply from the combat trains. To cover emergency resupply, a certain amount of ammunition and fuel were kept forward in the combat trains for this purpose. These supplies were used to resupply the units when ammunition and fuel is needed before the LOGPAC deliveries arrives.

Another deficiency with LOGPACs is that they tie up valuable transportation assets. Vehicles are tied up from the time they are loaded to the time they return from supplying the company. During the rotations, a large amount of time was wasted while waiting for someone from the company to meet at the logistics release point (LRP) and pick up the fuel trucks and supply trucks for his company or team. Then the truck was tied up with the unit till they released it to go back to the field trains and pick up more supplies.

Another deficiency with LOGPACs is that it does not always provide the right quantities of fuel and ammunition. Some units during their rotation coordinated the LOGPAC in the morning and delivered it at night. What happen during the day was not always incorporated into the night LOGPAC delivery. Shortages resulted. During one unit mission, the main effort did not receive the needed ammunition and

fuel. It had to conduct its operations without all the class III and V it needed.

These are recurring deficiencies in sustaining forward during NTC rotations. These deficiencies can hinder mission performance. Especially when it hinders one of the two key sustainment needs in the offense -- ammunition and fuel.

3rd Infantry Division's Logistic SOP

Understanding the importance of ammunition and fuel in sustaining, the 3rd Infantry Division developed an appendix to its division logistic standing operating procedure (SOP). The SOP addresses ROM operations, LOGPAC operations and ammunition resupply. By standardizing sustainment operation the division feels it can better support the maneuver commanders.

The ROM SOP provides information and assigns responsibility for the execution of ROM operations. The general concept is for the maneuver commander to coordinate with the FSB commander for a ROM site to support a long move. The maneuver unit S-3 coordinates with the FSB's support operation officer for the location and operation. The POL platoon leader from the FSB chooses two sites and provides the 5,000 gallon tanker and operators.

The LOGPAC SOP provides information and assigns responsibility for the execution of LOGPAC operations. The

headquarters and headquarters company (HHC) commander has direct responsibility for the task force/battalions LOGPACs. The unit's supply sergeant organize them in the field trains location. Each company's LOGPAC consists of the company's supply truck, a battalion POL and ammunition truck, and any additional vehicles carrying additional supplies. The support platoon leader takes them forward to the logistics release point. Here the company's first sergeant picks up the supplies and returns to the unit's location to resupply the units.

The ammunition resupply portion of the SOP calls for division to establish standard ammunition push packages. These packages are designed to support armored units, mechanized infantry units, or teams combining armored and mechanized infantry units. By standardizing the ammunition push packages, units need only to request when their request exceeds the standard. POL push packages have also been established to support armor, mechanized infantry, or teams combining armor and mechanized infantry.

Lessons Learned From Operation Desert Storm

In January - March, 1991, the United States, as part of a United Nations Coalition, fought in Operation Desert Storm, the largest war involving heavy forces to date. The lessons learned from this war further establish a framework

to help understand a need to standardize a guide to rapidly arm and refuel forward.

Desert Storm served to emphasis several logistics lessons learned. First the need for combat service support to be agile and mobile enough to keep up with the units its support. Second the large amount of supplies especially fuel that must be pushed forward to keep today's mechanized forces maneuvering. Third the usefulness of supplying class V to units in the front with CCLs instead of a single item bulk load. Although these apply to the corps and division they are just as applicable to supplying units forward of the BSA.[21]

Conclusion

As I reviewed the literature on forward arming and refueling points, I noticed that doctrine and technology is changing rapidly, but the support doctrine is behind. The last true study of arming and refueling in the battalions was in 1976. That study made several conclusions that the Army acted upon. The Army now uses the service station method and the ROM kit to refuel combat battalions forward. Due to the increase in fuel and ammunition usage and the rapid need for resupply, the Army has increased the number of 5-ton trucks for arming armor and infantry battalions and developed a larger, faster vehicle, the HEMTT. The HEMTT POL carrier carries twice the fuel of a 5-ton truck with tank and pump units. The POL HEMTT also has two

discharge nozzles which pump faster than the one on the tank and pump units on a 5-ton truck. The cargo HEMTT has twice the payload for hauling ammunition and other supplies as the 5-ton cargo truck.

The Army Material Command (AMC) is also researching and developing other ideas. One idea is the Armored Forward Area Rearm Vehicle (AFARVS). Another idea is a better methods of storing and shipping ammunition forward through the palletized load system (PLS). Doctrine needs to develop along with the equipment.

Current doctrine covers how to supply class III and V forward to the forward support battalion in the BSA but not to the maneuver units. The only mention of resupply to the units is through logistic packages (LOGPACS). Neither the combat arms or the combat service support community have developed a doctrine or a tactic, technique, or procedure (TTP) for LOGPACS. A doctrine or TTP could provide needed guidelines for forward area rearming and refueling.

FARPs should be studied for publishing as a support doctrine and/or a tactics, techniques, and procedures (TTP) for battalion S-4s and support platoon leaders. By studying and publishing these ideas and concepts, others can review and utilized them. Commanders would be better served if this lack of doctrine or TTP for arming and refueling forward of the BSA was resolved. It is causing

the support doctrine to fall behind. Therefore sustainment doctrine is not keeping pace with the Army's "How to Fight" doctrine.

Endnotes

1. U.S. Army, FM 100-5, Operations (Washington: Department of the Army, 1986), 14.

2. Anthony H. Kral, "Sustaining Patton's Pursuit," Army Logistician (July-August 1992), 28-29.

3. U.S. Army Logistics Center, Combat System Rearm/Refuel in Battalions Study (COSRRIB) (Fort Lee: Department of the Army, 1976), iv.

4. Ibid., 10.

5. William Ross and Charles Romanus, The Quartermaster Corps, Operations in the War Against Germany (Washington D.C.: Government Printing Office, 1965) 159.

6. Wayne Studebaker and James Christopher, Forward Area Refueling Equipment (FARE) (Fort Belvoir, VA: U.S. Army Mobility Equipment Research and Development Center) 1-6.

7. Ibid., 4-6.

8. George Merklinger, "His What is Hot to Trot? His FARRP, Man!" United States Army Aviation Digest Volume 21 (July 1975): 8-9.

9. Major Edmond R. York, Forward Area Refueling and Rearming Point (FARRP) Test Report, (Fort Hood, Texas: Modern Army Selected Systems Test, Evaluation, and Review, June 1973, 1-1.

10. U.S. Army Logistics Center, Combat System Rearm/Refuel in Battalions Study (COSRRIB) (Fort Lee: Department of the Army, 1976), 4-1.

11. FM 100-5 (1986), 91.

12. FM 100-5 (1986), 94.

13. U.S. Army, FM 71-2 The Tank and Mechanized Infantry Battalion Task Force (Washington: Department of the Army, 1988) 7-12.

14. FM 71-2 (1988) 7-14 - 7-14.

15. FM 100-5 (1986), 60.

16. FM 71-2 (1988), 7-14 - 7-18.

17. FM 100-5 (1986), 61.

18. U.S. Army, FM 9-6 Munitions Support in the Theater of Operations (Washington: Department of the Army, 1989), 2-7.

19. Combat System Rearm/Refuel in Battalions Study (CORSRRIB) (1976), 4-1.

20. Wilson Rutherford III, "Brute Force Logistics," Military Review (March 1993): 68.

21. Ibid., 68-69.

CHAPTER 3

RESEARCH METHODOLOGY

In the previous chapter, I reviewed the literature on forward area arming and refueling. I also reviewed the present sustainment doctrine for today's offensive operations. This literature analyzed and recommended solutions for the need for rapid arming and refueling as far forward as possible. The conclusion from the review of literature stated a need for a doctrine or TTP for arming and refueling forward of the BSA. This would help the sustainment doctrine to keep pace with the tactical doctrine.

My research methodology for a doctrine or TTP revolved around analyzing published studies, doctrine and lessons learned. First, I researched existing studies and literature to find a doctrine which could serve as a guide. Then with a guide or framework, I tried to find methods for arming and refueling forward that could be applied to the armor and mechanized infantry units. As I studied these methods, I limited my study to using existing TO&E personnel and equipment. Then, I compared the capabilities to the arming and fueling requirements as

stated in Field Manual 101-10-1, Staff Officers Manual, for planning and consumption factors.

The Guide or Framework

Field Manual 1-104, Forward Arming and Refueling Points, provided the overall guide to my research and analyses. It established Forward Arming and Refueling Point (FARP) doctrine for the aviation community. It evolved from the extensive studies and test conducted by the aviation community. It provide a proven framework for developing an arming and refueling point for armor and mechanized infantry units in the forward area.

Methods of Forward Area Arming and Refueling

Using Field Manual 1-104, Forward Arming and Refueling Points (FARP), doctrine as a guide or framework, I reviewed and analyzed the published studies, literature, and lessons learned. It established the organization, operation, and employment of forward area arming and refueling points. From this doctrine, I could establish an arming and refueling point organization, operation, and employment framework for mechanized infantry and armored units.

First, I reviewed and analyzed the literature and studies done by the aviation community. The aviation community has done extensive studies on this subject. They realized a need for forward area arming and refueling with

the heavy reliance on the helicopter during the Vietnam War. During this war, the helicopter proved its worth for combat service support and for combat or fire support. These past studies analyzed and recommended solutions to the need for rapidly arming and refueling as far forward in order to maintain combat effectiveness.

Continuing to use the FARP doctrine as a guide, I reviewed the mechanized and armor communities' studies and literature. Included in this review was the lessons learned from Operation Desert Storm and from the National Training Center and the Standard Operating Procedures for the Third Infantry Division (Mechanized). I reviewed the methods used for forward area arming and refueling for their advantages and shortcomings in the framework of organization, operation, and employment. Also I looked to see if the aviation FARP doctrine could be applied in a modified form.

Table of Organization and Equipment

Next, I reviewed the TO&E for the class III and class V platoon of an aviation unit and the support platoon of a mechanize infantry and armor units. The class III and class V platoon has the responsible for employing and executing FARP doctrine. From this information, I compared the capabilities and requirements of the platoons. This review allowed me to establish a framework for providing

the capability to execute the arming and refueling point using existing TO&E personnel and equipment.

Requirements

Once the capabilities were reviewed and analyzed, I then had to compare them against the requirements. I use the consumption table for class III and class V in FM 101-10-1, Staff Officer Manual, to determine the ammunition and fuel requirements. The tables provided planning factors and the requirements for offensive operations. Worst casing the scenario, I used the class V consumption rates for heavy or intense operations. For computing the fuel requirement, I also worst cased the scenario. I used the class III planning factors for operations in the European Theater, which are the highest consumption rates.

Conclusion

My research methodology proved sound due to the similarities of the aviation and mechanized or armor units. Aviation, mechanized infantry and armored units all move rapidly and concentrate firepower quickly to meet the needs of the maneuver commander. They all operate from the forward in the main battle area. They all have platoons authorized to accomplish their need and requirement for a rapid means of arming and refueling forward.

Due to these units' similarities, FARP doctrine provides an excellent guide or framework to work from. Working from this framework, I could then correlate the *mechanized infantry* and armor studies and literature to the aviation studies and literature. Correlating the capabilities was done by comparing the personnel and equipment of the aviation class III and class V platoon and the mechanized infantry and armor's support platoons.

CHAPTER 4

ANALYSIS

The previous chapters stressed the significance of this thesis, reviewed past studies and literature, and established the guide or framework for my research. My review identified the problem of the lack of any clear guidance on arming and refueling forward of the Brigade Support Area (BSA). As discussed in Chapter Two, our current sustainment doctrine provides an adequate means to push the critical supplies of ammunition and fuel from the corps to the BSA. At this point the doctrine is vague. Units rely on a loosely structured system of sending logistics packages forward called LOGPACs.

LOGPACs are administrative in nature and do not fulfill the needs of the commander. They are organized in the field trains and moved forward normally once a day. Special LOGPACs are organized as required. This does not always meet the maneuver units need. The maneuver battalions need a better means to rapidly arm and refuel in offensive operations.

The FARP doctrine is a framework for them to work from. Field Manual 1-104, Forward Arming and Refueling

Points, describes the purpose, organization, personnel, and the planning factors for establishing the aviation unit's FARP. Mechanized infantry and armor units can use this field manual as a guide for their forward area arming and refueling needs in offensive operations.

Purpose

Field Manual 1-104 states "The function of the FARP is to provide the commander with the means to increase his time on station. When the turnaround time associated with class III and V activities are reduced then the commander has more time to apply continuous pressure on the enemy."[1] The same function and need for a quick turnaround applies to the ground maneuver forces.

Chapter One described the function of the mechanized infantry and armored FARP, and how it provides the commander with the means to arm and refuel quickly so he can continue operations. Field Manual 71-2 states

> The missions of the mechanized infantry and battalions in their pure configuration are--
> (1) The mission of the mechanized infantry battalion is to close with the enemy by means of fire and maneuver in order to destroy or capture him, or to repel his assault by fire, close combat, and counterattack.
> (2) The mission of the tank battalion is to close with and destroy enemy forces using fire, maneuver, and shock effect, or to repel his assault by fire and counterattack.[2]

To accomplish their mission task of fire and maneuver, they need to rapidly rearm and refuel forward. FARP doctrine can support these missions.

Lessons learned from Desert Storm and NTC reinforce the function of the FARP. Successful sustainment of the arming and fueling function can predicate a maneuver commander's success. Unit must have a plan for and execute class III and V replenishment for the maneuver elements.

During Desert Storm, the left hook by the VII Corps could not have happened without the prepositioning of forward logistics bases for the units to move through and resupply.[3] By planning and executing these forward logistics bases, VII Corps had the means to sustain continuous offensive operations. These same sustainment needs exist for unit commanders at the battalion and company level.

At NTC units which did not adequately plan for resupply reduced their units' ability to maintain continuous pressure on the enemy. Even worse, some units had to continue operation without the ammunition and fuel to support their operations. A FARP doctrine could have prevented this from occurring.

FM 1-104 also states under the FARP's purpose that,

> As a general rule, FARPs are employed when-
> a. The tactical situation is such that the turnaround time to the unit trains is too long.
> b. Time in station must be optimized.
> c. A rapid advance is being conducted and the units trains cannot keep pace.[4]

Logistical support for VII Corps during Operation Desert Storm identified the need for agile and mobile sustainment for a heavy mechanized force. Class III and V must be pushed to units as fast as they need it.[5]

Organization

The personnel and equipment to rapidly refuel and replenish ammunition forward exist under current and future Tables of Organization and Equipment in the battalion support platoons and forward support battalions. The support platoons of both the armor battalion and a mechanize infantry battalion are divided into four company III/V squads whose function it is to transport ammunition and fuel to the companies. These squads are similar in design and function to the III/V platoon of an attack helicopter battalion. Each support platoon also has a transportation section with the function of transporting ammunition, fuel, and other supplies to the battalion units. In the forward support battalion the supply company has a class V (ATP) section whose function it is to transfer ammunition from corps transportation to supported units' vehicles. The supply company also has a POL section whose function is to provide mobile storage and issue of bulk class III to brigade units.

The mechanized infantry support platoon is authorized 35 enlisted personnel to handle the

transportation of and issuing of fuel and ammunition. The tank battalion is authorized 34 enlisted personnel to handle the transportation and issuing of fuel for the battalions. The forward support battalion's class V (ATP) and class III section consist of 10 ammunition specialist and 14 petroleum specialist, respectively. The enlisted personnel's military occupational specialties range from petroleum specialist (77F) and transportation specialist (88M) to ammunition specialist (55B).

Each battalion's support platoon has the equipment and the capability to transport and distribute to the battalion's units their ammunition and fuel needs. An infantry battalion support platoon can transport and distribute over a 143 tons of ammunition using its thirteen cargo HEMMTs and 20,000 gallons of bulk fuel using its eight fuel HEMMTs. An armor battalion support platoon can transport and distribute 88 tons with its eight cargo HEMMTs and 30,000 gallons of fuel with its twelve fuel HEMMTs.

These personnel and this equipment are established by the Army's Table of Organization and Equipment to provide transportation and class III and V support to the all elements of the battalions. By colocating the fuel and cargo HEMMTs at a ROM site, the support platoons provide the capability to establish a Forward Arming and Refueling Point (FARP). The FARP has the capability to sustain the

units offensive mission requirements. The FARP can provide support throughout the battlefield in all conditions.

Arming Operation Summary

FARP operations can be divided into the two sustainment functions of arming and fueling. These two functions allow a good division for analyzing capabilities and requirements for establishing a FARP. First, we will analyze the arming operation of the FARP.

The Army's doctrine has identified arming as one of the six key sustainment functions. The Army continues to study to determine the best method for rearming units as doctrinal changes occur and as new equipment emerges. Historical examples and lessons learned from one of our premier training centers, the National Training Center (NTC), shows a need to provide a more rapid and responsive forward arming capability. By analyzing current organization one can see that the personnel and equipment exist to form a FARP.

The TO&E provides class III/V squads in each maneuver battalion. These squads handle the transportation and distribution of ammunition and fuel to the line companies. They also provide the resources for company LOGPAC operations. By analyzing how the aviation units establishes a FARP and comparing capabilities with the company LOGPAC, one can see that their exist a simple means

to inject into the doctrine a way to rapidly rearm and refuel forward. This method will provide a forward rearm and refuel procedure for the sustainment of offensive tactical operations.

First the sustainer must determine what the ammunition requirement is for the units and what is their transportation capability. Using the planning factors for ammunition consumption from FM 101-10-1, the mounted and dismounted elements of a M2 Bradley Infantry Fighting Vehicle needs a total of about .5 tons or 47.8 cubic feet of ammunition resupplied when engaged in heavy offensive contact the first day operation. The HEMTT can haul up to 11 tons or 427.5 cubic feet of ammunition. By colocating a HEMTT from the class III/V squad loaded with ammunition at the ROM refuel point, units could be armed and refueled forward. The HEMTT could provided enough ammunition to rearm up to about 9 M2 Bradley Infantry Fighting Vehicles and dismounted elements. More Bradleys could be rearmed if the units did not require the larger items such as TOW and Dragon missiles which causes the HEMTT to cube out before it weights out.

Using the same planning factors, the M1 Abrams Tank requires about 1.7 tons or 54.8 cubic feet of ammunition. Tank battalion support platoons resupply units using the HEMTT. The HEMTT could carry enough ammunition to rearm about eight tanks. Again, the HEMTT cubes out before it

weights out. Since the main gun rounds cause the HEMTT to cube out, the ammunition load cannot be adjusted to allow for additional ammunition.

As the offensive operation continues to day 2 and beyond, the amount of ammunition used decreases. Statistical data and a review information on Operation Desert Storm substantiate this. During Operation Desert Storm, much of the ammunition that was pushed forward was not consumed.[6] One of the reasons for this is the technology of today's weapons systems and ammunition. The high tech sights and range finders on today's infantry fighting vehicle and tank assure a high percentage of first time hits and kills.

Refueling Operation Summary

The FARP also sustains the fuel function of mechanized infantry and armor units. The fueling function of sustainment is considered critical during offensive operations. As discussed previously the Quartermaster School designed a Refuel on the Move (ROM) kit which allows units to refuel from 4 to 24 vehicles rapidly during offensive or defensive operations. Heavy divisions such as the 3rd Infantry Division (Mechanized) have developed SOPs on the conduct of ROM operations. At the National Training Centers, armor and mechanized infantry battalions are required to conducted ROM operations as an evaluated task.

Presently the unit requesting the ROM site coordinates with the FSB. The FSB is responsible for the setup of the ROM SITE. The class III platoon leader provides the 5,000 thousand gallon tanker has the fuel source. The hoses and 350 gallon per minute pump is connected and from four to eight points refueling points are setup. It can pump up to 44 gallons a minute at each point.

Another similar method of refueling is to hot refuel (see figure 5, hot refueling diagram). Hot refueling takes advantage of the capabilities of the HEMTTs found in armor and mechanized infantry support platoons. This equipment is part of the units TO&E. Each HEMTT has a 2,500 gallon tank and a 300 gallon per minute centrifuge pump and two hose reels each equipped with 50 foot of hose. Each hoselines can pump up to 50 gallons per minute.

Either or both of these methods can provide the refueling point for the FARP. First, the planner must understand what the fuel requirements are. The fuel consumption factors for an M1 and M2 must be computed. Using the planning figures from FM 101-10-1, in a European environment the M1 uses 645.1 gallons a day and the M2 uses 165.5 gallons a day. The total capacity for the M1 and M2 is 504 gallons and 175 gallons respectively. These planning figures for fuel consumption are the maximum consumption figures. They most closely relate to the consumption

figures for NTC or Operation Desert Storm. The M1 daily consumption figures exceeds its total vehicle storage capacity, so the sustainer should plan to refuel the M1 tank more than once a day.

By combining the ROM and/or hot refuel procedures with a established battalion ammunition combat configured load a Forward Arming and Refueling Point (FARP) can be established. According to METT-T, the supporting unit could establish a battalion or task force FARP or smaller.

Times Analysis

Time as a part of METT-T is a key factor in planning for the FARP site. First the class III and V requirements must be determined. Then the capabilities must be planned against the requirements. Time determines which capability is best suited for the requirement.

Fueling operations are determined by the amount of fuel needed and the equipment used. In the support platoons, the primary refuel vehicle is the HEMTT. It can pump from its organic pump at a rate of 50 gallons per minute at two separate nozzles. A HEMTT could refuel two vehicles simultaneously at a rate of 50 gallons per minute. So each HEMTT could refuel 150 gallons for two vehicles from the task force or team every three minutes.

The number of refuel points can be increased by using additional HEMTTs or by using the ROM concept with a

5,000 gallon tanker from the forward support battalion. ROM equipment allows dispensing from four to eight points at a rate of 44 gallons per minute. Using the above example, ROM provides the capability to refuel up to eight vehicles simultaneously in a little over three minutes.

Arming operations are determined by the amount of ammunition needed. In the support platoon, the cargo HEMTT hauls the CCL for the units from the ATP. The loading of the ammunition from the HEMTT on to the maneuver vehicles is done by the support platoon personnel and the using units personnel.

The time required to load is a function of how much ammunition has been expended. As mentioned earlier, the ammunition comes to the ATP in CCLs. These CCLs are configured so units are receiving ammunition in case lots. This allows the majority of the ammunition resupply to be done by transferring cases from HEMTT to the maneuver units vehicles. The exception are TOW or Dragon missile and 120 mm tank rounds. The majority of the ammunition is in cases which are transferred on to the using units vehicles. These cases can be loaded on to the vehicle while it is refueling and within the time it takes to refuel.

In offensive operation fuel consumption normally exceeds ammunition consumption. The time to refuel will normally dictate the amount of time the units spend in the FARP site. With the majority of the ammunition configured

in cases the arming time should fall within the refueling time.

Forward Arming and Refueling Points

FARPs could arm and refuel any size force from a company or team to a battalion or task force. They could be augmented with other supply vehicles to perform some of the same function of the LOGPACs. The number of fuel points and ammunition trucks would be determined by METT-T.

A company or team size FARP can be set up using the class III/V squad from the support platoon. If ammunition or fuel consumption exceeded the squad's capability, then additional fuel or transportation assets can be requested from the transportation section of the support platoon. The POL HEMTTs could set up similar to a hot refuel point with from two to eight points with an ammunition HEMTT colocated with them. These ammunition HEMTT would have preplanned CCL of the high density ammunition. As vehicles moved through to rapidly refuel, they could also replenish expended ammunition. Other supply functions normally handled through LOGPAC operation could be done, mission and time permitting. The first sergeant or supply sergeant could hand out mail, rations, or other supplies.

Conclusion

Given the capabilities of the battalion's support platoons and the requirement of the maneuver units and

based on my analysis, FARP doctrine can meet the need for forward area arming and refueling. A single FARP consisting of one class III and V squad can arm and refuel up to 200 gallons per vehicle for a company/team in less than 30 minutes. The time can be further reduced by adding additional arming and refueling points. This can be accomplished by colocating additional POL and ammunition HEMTTs from the class III and V squads or by establishing a ROM augmented with ammunition HEMTTs. Based on the requirements in FM 101-10-1 and the capabilities in the support platoons, the FARP procedures described in my thesis can meet the needs of the force and support the maneuver commander.

Endnotes

1. U.S. Army, FM 1-104, Forward Arming and Refueling Points (Washington: Department of the Army, 1985), 3.

2. U.S. Army, FM 71-2, The Tank and Mechanized Infantry Battalion Task Force (Washington: Department of the Army, 1988), 1-2.

3. Wilson Rutherford III, "Brute Force Logistics," Military Review (March 93): 65-66.

4. FM 1-104 (1985), 3.

5. Rutherford III, "Brute Force Logistics," 69.

CHAPTER 5

NATURE OF THE FARP

The earlier chapters established that the mechanized infantry and armor battalions accomplish their missions through superior maneuver and firepower. Through task organization, tank and mechanized infantry battalions increase their capability. Key to accomplishing their missions is the integration and synchronization of combat support and combat service support (CSS) combat multipliers. The FARP provides that CSS combat multiplier.

Field Manual 1-104 states, "The FARP should be operated and organized according to the factors of METT-T," and these same factors apply to the mechanized and armored unit's FARP. It should avoid the enemy while meeting the mission requirements of the mechanized infantry and tank battalions. Mechanized Infantry and tank battalion mission may change or vary but METT-T provides a standard base for FARP employment.[1]

FARP operations should be planned as part of the unit's overall concept of support. It should support the unit's overall concept of operations and scheme of maneuver. The FARP will meet the sustainment requirements

of the tank or mechanized infantry units throughout the battlefield.

As dicussed in Chapter Four, the TO&Es provides the majority of the personnel and equipment authorization based on the unit's mission requirements. The only augmentation is the ROM kit at the battalion level to enhance and expand refueling capability. Under the current structure the tank and mechanized infantry units have like equipment. Mission will dictate how the equipment and personnel of the FARP are employed.

FARP operations will become more supportable as other equipment such as the armored forward area rearming vehicle (AFARV) and the palletized loading system are developed and fielded by the Combat Service Support Command at Fort Lee, Virginia. FSB and battalion support platoons or other similar units will have the equipment necessary to establish a FARP. Still, the use of the equipment is dictated by the situation and the unit's mission.[2]

Location

(see FARP Supply Diagram)

Field Manual 1-104 provide guidance on location of the FARP that is applicable to mechanized and armored units. It states, "The FARP should be located as close to the area of operation as the tactical situation permits."[3] This same principle applies to mechanized

infantry and tank battalions. Locating the FARP forward of the BSA is essential to providing the class III and V support the mechanized infantry and armored units need in offensive operations.

Its location should be proposed by the S-4 in coordination with the S-3. The FARP should be located 5 to 10 kilometers behind the Forward Line of Troops (FLOT) and forward of the Brigade Support Area. This keeps the location of the FARP out of small arms range. The FARP is forward of the BSA and can be easily resupplied from the BSA's ATP and class III point. The distance also reduces the distance and time that combat units travel and spend rearming and refueling.

While location is important, so is cover and concealment. It is important to prevent the FARP from detection from enemy ground and air threat.[4] Treelines, vegetation, shadows and built-up areas should be used to conceal FARP operations. Use of terrain folds and reverse slopes provide a mask from enemy observation. Masking prevents the enemy from targeting the FARP through visual or electronic means. Concealment must also be considered and accomplished by tactical dispersion of vehicles and support equipment.[5]

Time Requirement

The time available to arm and refuel a unit, whether it is a battalion task force or a company team, is a function of METT-T. The commander must determine using METT-T if he has time to partially rearm and refuel or to completely replenish the basic load of ammunition and top-off the vehicles with fuel. The commander must determine the risk he is willing to take by pulling a unit out in order to replenish it.

Planning for the FARP site should be part of the Operation Plan (OPLAN). After the S-3 has wargamed his concept of operation, the S-4 then determines the support requirement. He uses the consumption factors in FM 101-10-1, Staff Officer Planning Manual, or historical data to predict the requirements for class III and V. He then determines what capabilities are needed to fulfill the requirement. Considering the requirements and the capabilities, he approximates the amount of time involved in conducting the FARP operations.

The support platoon leader uses the time involved in conducting FARP operations to determine the length of time each vehicle spends at an arming and refueling point. He should have each fuel point operator maintain a stopwatch to keep up with the amount of time a maneuver vehicle spends at the point. If a vehicle needs 150 gallons of fuel, then the vehicle should spend no more than three

minutes at the rearm and refuel point. The ammunition loading should fall within the time allotted for refueling given the ammunition is configured in cases for distribution. This assumes that the ammunition consumption is normal for offensive operations.

Task Force Support Packages

Today's units fight as battalion task forces or as company teams. These units are formed when units are cross-attached. Usually a tank company will be cross-attached to a mechanized infantry battalion or the other way around.

When units are cross-attached, the necessary combat service support slice should go with it. (See Service Support Diagram) This ensures the gaining unit can support the cross-attachment. The class III and V assets in the support package would ensure the gaining unit maintained its ability to establish a FARP. Units cross-attaching should always come with a service support package. This would prevent it from degrading the task force's support capability.

Emplacement

The FARP should be mobile enough to be transported and emplaced by the organic ground transportation assets of the support platoon or forward support battalion. Consideration should be given to the unit's mission and the

FARP's expected time to be operational. The FARP should be designed so that it can be quickly emplaced into operation. The support platoon personnel and forward support battalion personnel should be trained and ready to set up the FARP and to pack it up and move without leaving behind debris, fuel, ammunition, or equipment. FARP emplacement procedures, operations and pack-up procedures need to be collective tasks that the units train on periodically.[6]

The ground vehicles that carry the bulk fuel and ammunition should also transport the equipment and personnel for emplacing the FARP. The advantages stated in FM 1-104 state it best that:

1. "Ground mobility offers the advantages of responsive organic FARP moblity and the ability to carry large amounts of bulk POL."[7]

2. "Ground vehicles are the primary means to displace and resupply the FARP."[8]

3. Ground transport maintains it mobility in inclement weather as compared to air transport.

4. Ground transport can set up and support from terrain that air transport cannot land at.

Ground transport does have disadvantages that must be considered prior to emplacement. One is that it is subject to road and traffic conditions. The second disadvantage is that the resupply vehicles are normally the same vehicles that transport the FARP and the bulk fuel and

ammunition. The third disadvantage is the accessibility of the site. With the limited number of resupply vehicles and equipment in the battalion, FARP operations can be hindered or jeopardized by a loss of these vehicles and the equipment and supplies on the vehicles.[9]

FARP Relocation

Field manual 1-104 povides a reference for mechanized and armored units to use in basing the relocation of the FARP. FARPs locations are temporary. As fluid as the battlefield is, the FARPs should be ready to move often. They may move due to the position being compromised or when the support is complete.

The last unit to go through the FARP should notify the FARP of orders to relocate or the rear command post could contact the FARP. A simple message in a fragment order (FRAGO) format should be used. The message should contain the following:

a. Grid location of new and alternate site.

b. Time to be operational.

c. Ammunition and fuel requirements.

d. Unit to be supported and march table.

e. Enemy situation.

The FARP relocation should be an orderly movement. First, the advanced party should breakdown and prepare to move first. The advanced party should have the

capability to do a limited amount of arming and refueling. Then the advanced party should reconnoiter the route and new site. It should establish limited security and ground guides, determine traffic flow, and arming and refueling points. The advance party should then establish a class III and V point with the limited amount of arming and refueling assets.

The remaining FARP elements should break down and relocate when called forward by the advanced party. The remaining elements should use the route reconnoitered by the advanced party. At the new location, the ground guides should guide elements into the new position. Then the remaining elements should set up the arming and refueling points. Once the point is fully operational it should notify the rear command post.[10]

Command and Control

Command and control is essential to the FARP. The battalion's support platoon leader should move forward and provide command and control for a FARP. He is the officer in charge of transporting and resupplying the battalion with class III and V. The majority if not all the assets to establish the FARP come from the support platoon. He also has dual net capability for use in controlling the FARP. This capability also allows him to coordinate units with moving through the FARP site and with field trains.

Having the support platoon leader in charge with his communication assets has several advantages. He could request and coordinate for FARP resupply of ammunition and fuel. Also he can provide situation reports if the FARP came under attack. He could then notify the field trains of the status of the FARP's damage and ability to complete the mission. He could communicate between the FARP and the field trains as to relocations, changes in operations, and completed operations.

Internal control of the FARP can be provided through radios in the platoon leader's vehicle or through one of the additional PRC-77 in the platoon's TO&E. As a back up, the unit being resupplied will have communication assets. These can be used for external and internal communications.

These radio transmissions should only be made when necessary. The enemy's capability to target and engage electronic emission locations requires that radio transmission be kept to a minimum. Fewer transmissions will allow the enemy less of a chance to pinpoint the FARP location and attack it.

Security

Besides radio transmissions other means of providing security are required. Security should be planned such that it does not hinder the movement and operation of the

FARP. Yet the security must be enough to meet the anticipated level of threat.

The security of the FARP must be coordinated and planned. The support platoon leader should have a security plan. Then he needs to coordinate with the unit being resupplied for security of the site. The location should be tied into an air defense umbrella to protect it from aerial attack. On the ground, listening posts (LP) or observation posts (OP) along with quick reaction squad provide limited security. Nuclear, Biological, and Chemical (NBC) monitoring equipment should be placed upwind to provide early warning. If available, early warning devices should be used.[11]

Multiple FARP Operations

The ability to establish multiple FARP operations would allow for uninterrupted support. Multiple FARP operations would provide uninterrupted support to attacking elements during the FARP resupply and/or relocation. If possible the planner should divide up assets or coordinate external assets to provide operating, relocating, and reserve FARPs.

By providing the battalion's support platoon with ROM kits allows them to set up multiple FARP sites. These FARP operations could be tailored to the units needs. The

limiting factor would be the number of ammunition trucks needed by the requesting unit.

Conclusion

FARP provides the combat service support for mechanized and armor units to accomplish their missions. By using the personnel and equipment organic to the support platoons, units have the capability to command, control, operate, and secure a FARP site. The site can support a company team or a battalion task force.

Endnotes

1. U.S. Army, FM 1-104, Forward Arming and Refueling Point (Washington: Department of the Army, 1985), 4.

2. Ibid

3. Ibid.

4. Ibid., 7.

5. Ibid., 4.

6. Ibid., 5.

7. Ibid.

8. Ibid.

9. Ibid.

10. Ibid.

11. Ibid., 7.

12. Ibid., 5.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

Forward Arming and Refueling Points can provide a responsive means to sustain heavy divisions' maneuver units. A heavy division maneuver force's consumption rates and planning factors provide the justification for these points. Aviation FARP doctrine provides a base for the mechanized units to use in organizing and operating a forward area arming and refueling point. The support platoons have the resources to man and equip these mechanized infantry and armored FARPs. If the battalions' support platoons are provided with ROM kits, they could increase they refueling capacity by increasing the number of refuel points available at the FARP. This would increase the speed at which they could refuel the battalion. As a backup, the FARP operations could be augmented by the personnel and equipment of the forward support battalion.

Recommendation

I recommend the Army publish a field manual outlining FARP doctrine, operations, and procedures for mechanized infantry and armored forces. Also, the infantry

branch and armor branch should follow the aviation branch and conduct additional studies. These studies should be done to determining human engineering information, procedures and uploading times for ammunition to the weapon systems. These studies could result in reconfiguring the basic loads and preplanning of the combat configured loads. FARP doctrine and these studies will result in a better sustained force.

GLOSSARY

A

AB - aviation brigade

alog - administration and logistics

AO - area of operations

AR - Army regulation

ASL - authorized stockage list

ASP - ammunition supply point

ATP - ammunition transfer point

autmv - automotive

AVIM - aviation intermediate maintenance

avn - aviation

AVM - aviation unit maintenance

B

BCOC - base cluster operations center

bde - brigade

BDR - battle damage repair

bn - battalion

br - branch

BSA - brigade support area

C

C2 - command and control

CCL - combat-configures load

cdr - commander

co - company

COSCOM - corps support command

CP - command post

CSA - corps storage area

CSCC - combat stress control coordinator

CSR - controlled supply rate

CSS - combat service support

CTA - common table of allowances

ctr - center

D

DA - Department of the Army

DAO - division ammunition officer

DD - Department of Defense

DISCOM - division support command

dist - distribution

div - division

DMMC - division materiel management center

DODAC - Department of Defense Ammunition Code

DS - direct support

DSA - division support area

DTO - division transportation officer

E

EA - engagement area

EAC - echelons above corps

eng - engineer

F

FARP - forward arming and refueling point

FAST - forward area support team

fld - field

FLOT - forward line of own troops

FM - field manual, frequency modulated

FRAGO - framentary order

FSB - forward support battalion

fwd - forward

FARE - Forward area refueling equipment

G

G1 - Assistant Chief of Staff, G1 (Personnel)

G2 - Assistant Chief of Staff, G2 (Intelligence)

G3 - Assistant Chief of Staff, G3 (Operations and Plans)

G4 - Assistant Chief of Staff, G4 (Logistics)

G5 - Assistant Chief of Staff, G5 (Civil Affairs)

H

HEMTT - heavy expanded mobility tactical truck

HET - heavy equipment transporter

HHC - headquarters and headquarters company

HHD - headquarters and headquarters detachment

HQ - headquarters

hvy - heavy

I

ID - identification

inf - infantry

IPB - intelligence preparation of the battlefield

J

JP-4 - jet propulsion fuel, type 4

JP-8 - jet propulsion fuel, type 8

L

ldr - leader

LEN - large extension node

LID - light infantry division

LO - liaison officer

LOC - line of communication

log - logistics

LOGPAC - logistics package

LP - listening post

LRP - logistics release point

M

maint - maintenance

mat - materiel

MCO - movement control officer

MCP - maintenance collection point

MCS - maintenance control section, maneuver control system

mech - mechanized, mechanic

med - medical

METT-T - mission, enemy, terrain, troops, and time available

mgt - management

MHE - materials-handling equipment

MLRS - multiple-launch rocket system

MMC - materiel management center

MOGAS - motor gasoline

MOS - military occupation specialty

MP - military police

MRE - meal, ready-to-eat

MRO - materiel release order

MSB - main support battalion

MSR - main supply route

N

NBC - nuclear, biological chemical

NCO - noncommissioned officer

no - number

O

obj - objective

OCOKA - observation, concealment and cover, obstacles, key terrain, and avenues of approach.

off - officer

OIC - officer in charge

op - operator

OP - observation post

OPCON - operational control

OPLAN - operation plan

OPORD - operations order

P

petrl - petroleum

pkg - packaged

plt - platoon

POC - point of contact

POL - petroleum, oils and lubricants

POM - preparation for overseas movement

R

rds - rounds

rec - recovery

rep - repair

RF - reaction force

RP - release point

RSR - required supply rate

RSSP - ration supplement - sundries pack

S

S1 - Adjutant (US Army)

S2 - Intelligence Officer (US Army)

S3 - Operations and Training Officer (US Army)

S4 - Supply Officer (US Army)

S&S - supply and services

sgt - sergeant

SOP - standing operating procedure

sp - specialist

SP - start point

spt - support

sptd - supported

sqd - squad

sup - supply

supv - supervisor

svc - service

STON - short ton

T

T - ton

tac - tactical

TCP - traffic control point

TF - task force

tm - team

TM - technical manual

TMT - transportation motor transport

TOC - tactical operations center

TOE - table of organization and equipment

TOW - tube-launched, optically tracked, wire-guided

TPU - tank and pump unit

trkd - tracked

trmt - treatment

U

ULC - unit - level computer

ULLS - unit-level logistics system

US - United States

V

VA - Virginia

VHF - very high frequency

W

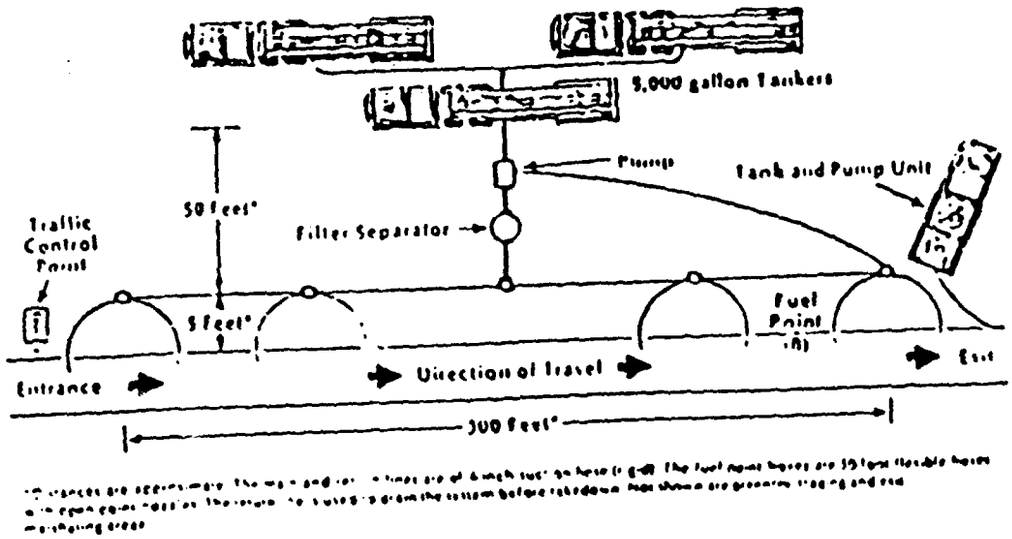
wh - wheeled

X

XO - executive officer

APPENDIX B

FIGURES



Typical refuel-on-the-move site layout

Figure 1. ROM Diagram

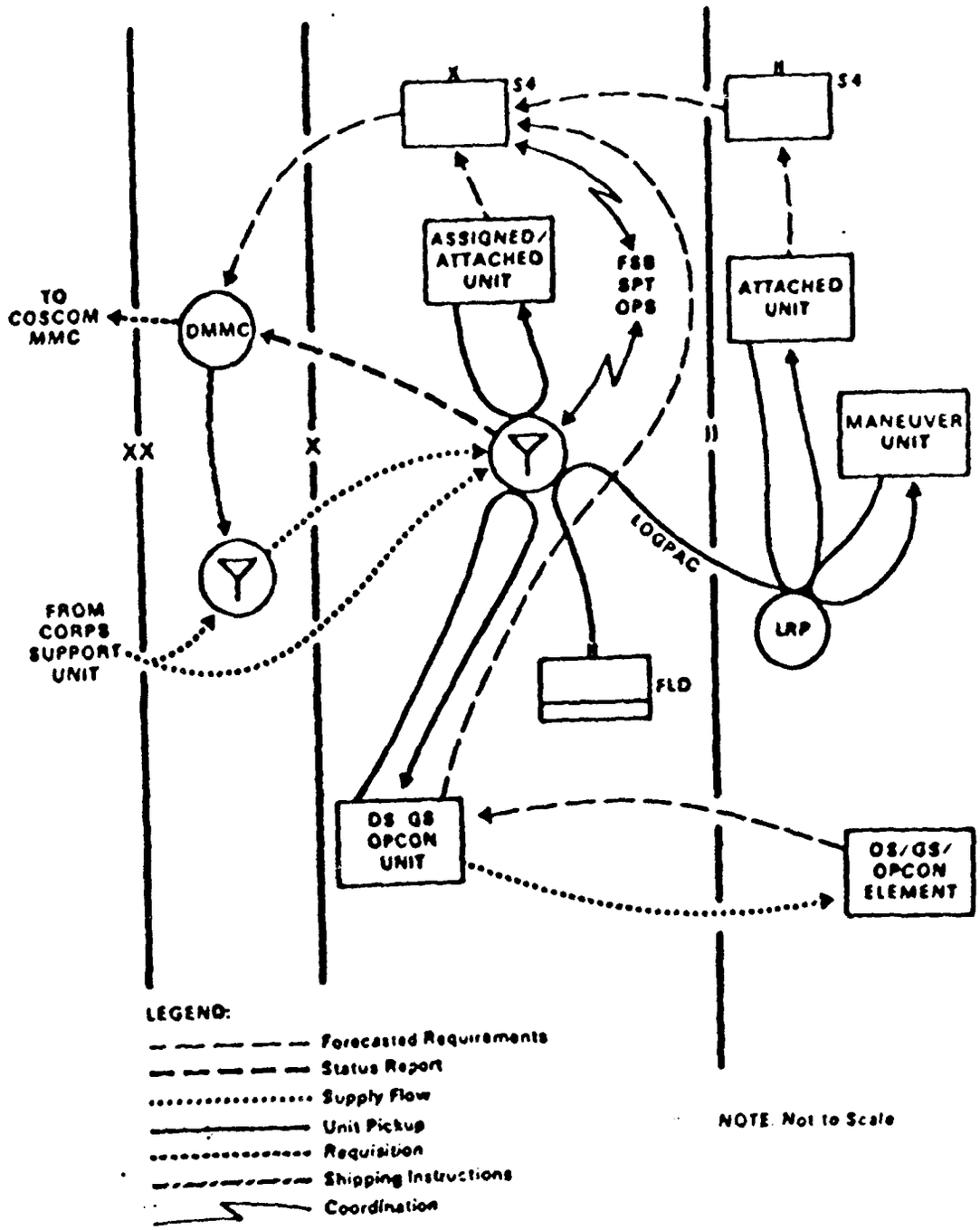


Figure 2. Fuel Supply Diagram

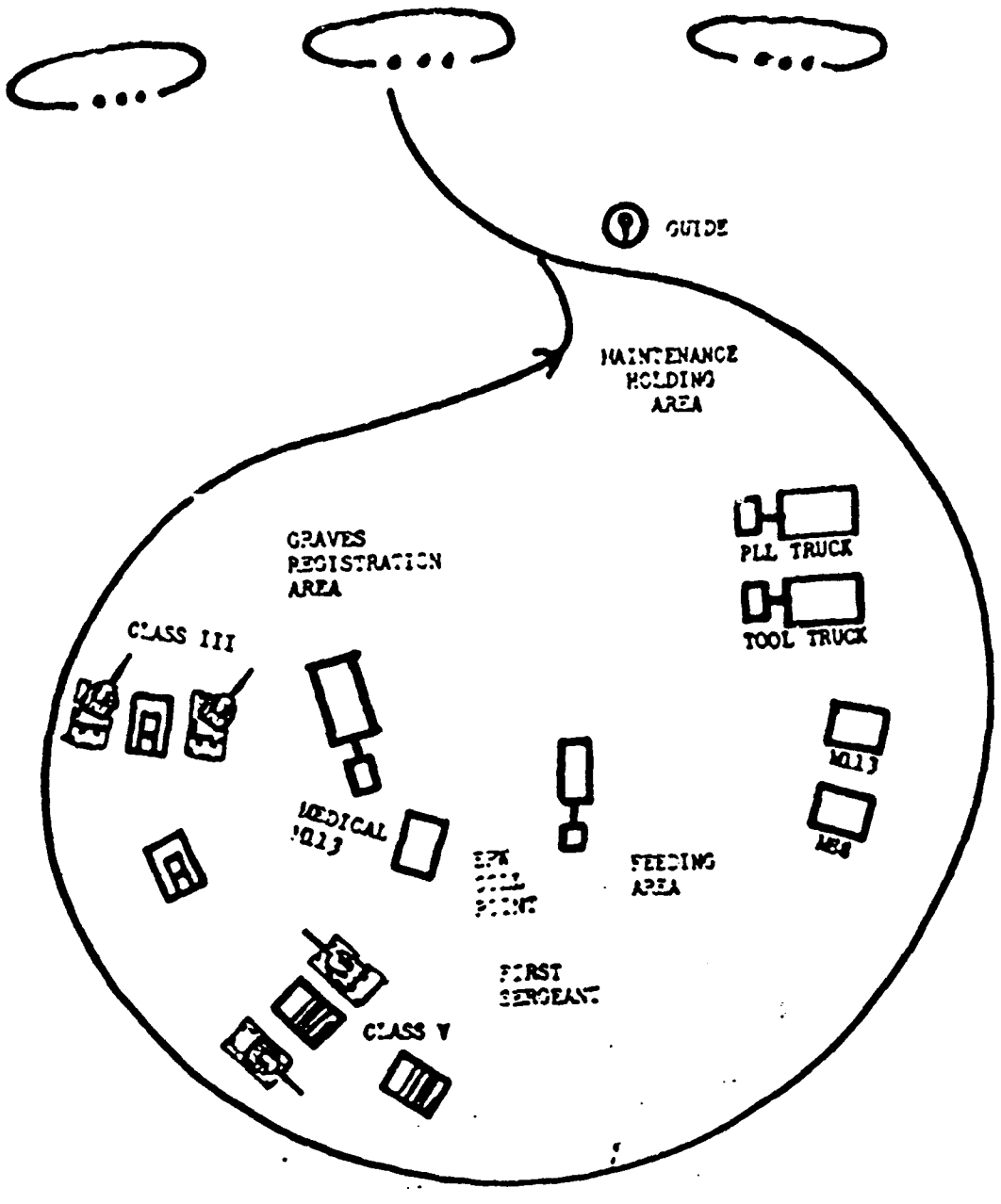


Figure 3. LOGPAC Operations

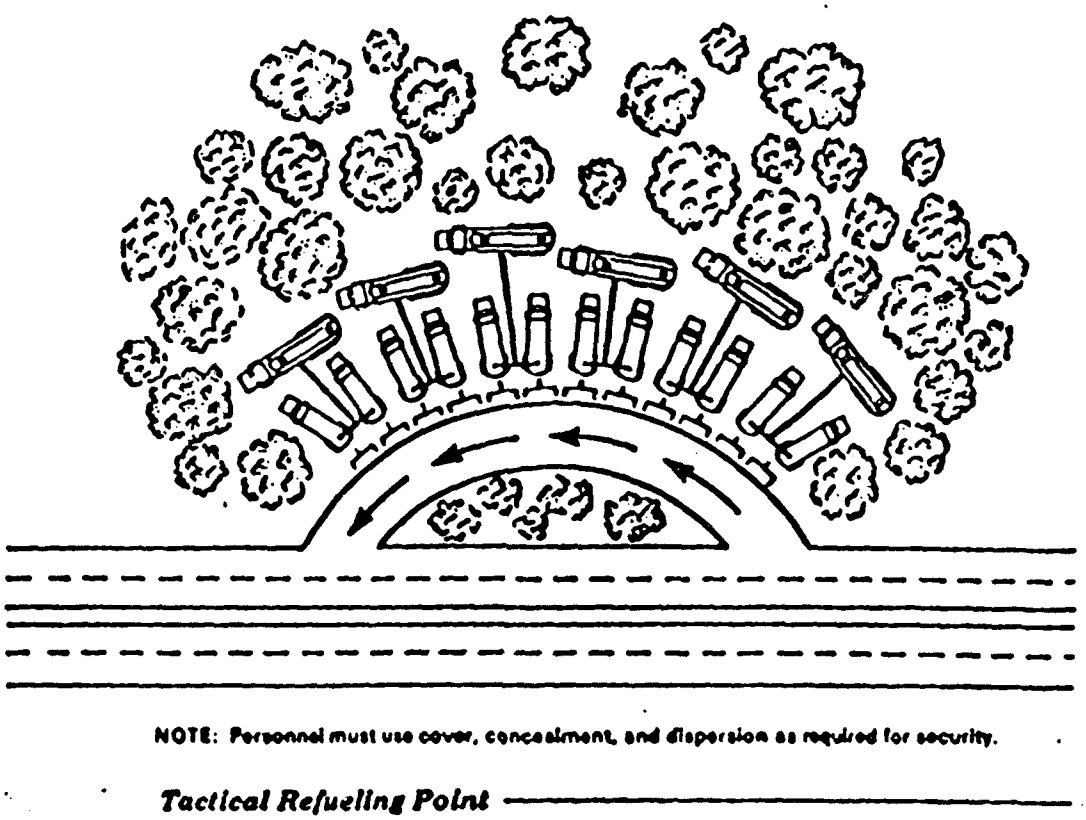


Figure 4. Tactical Refueling Point

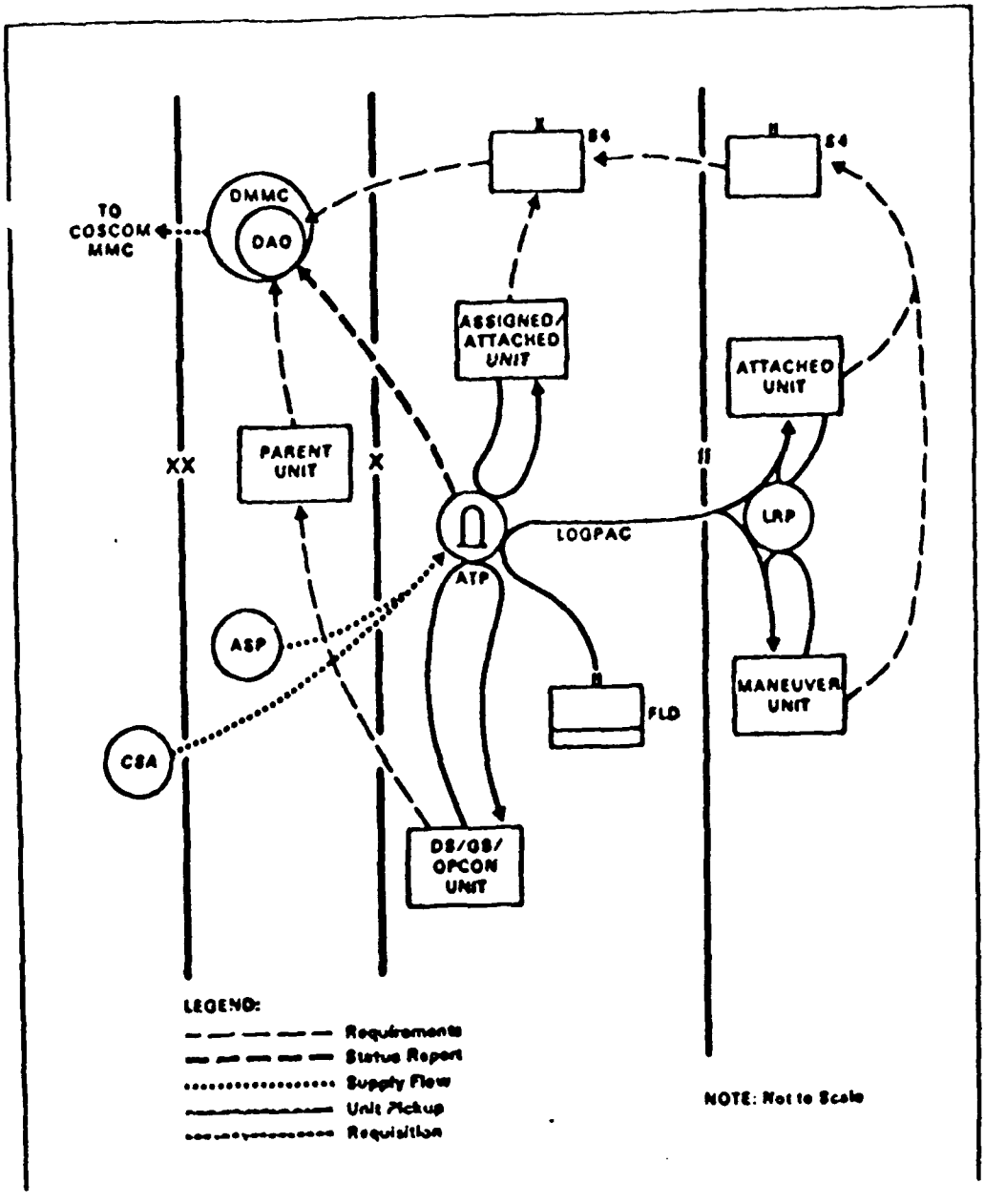


Figure 5. Ammunition Supply Diagram

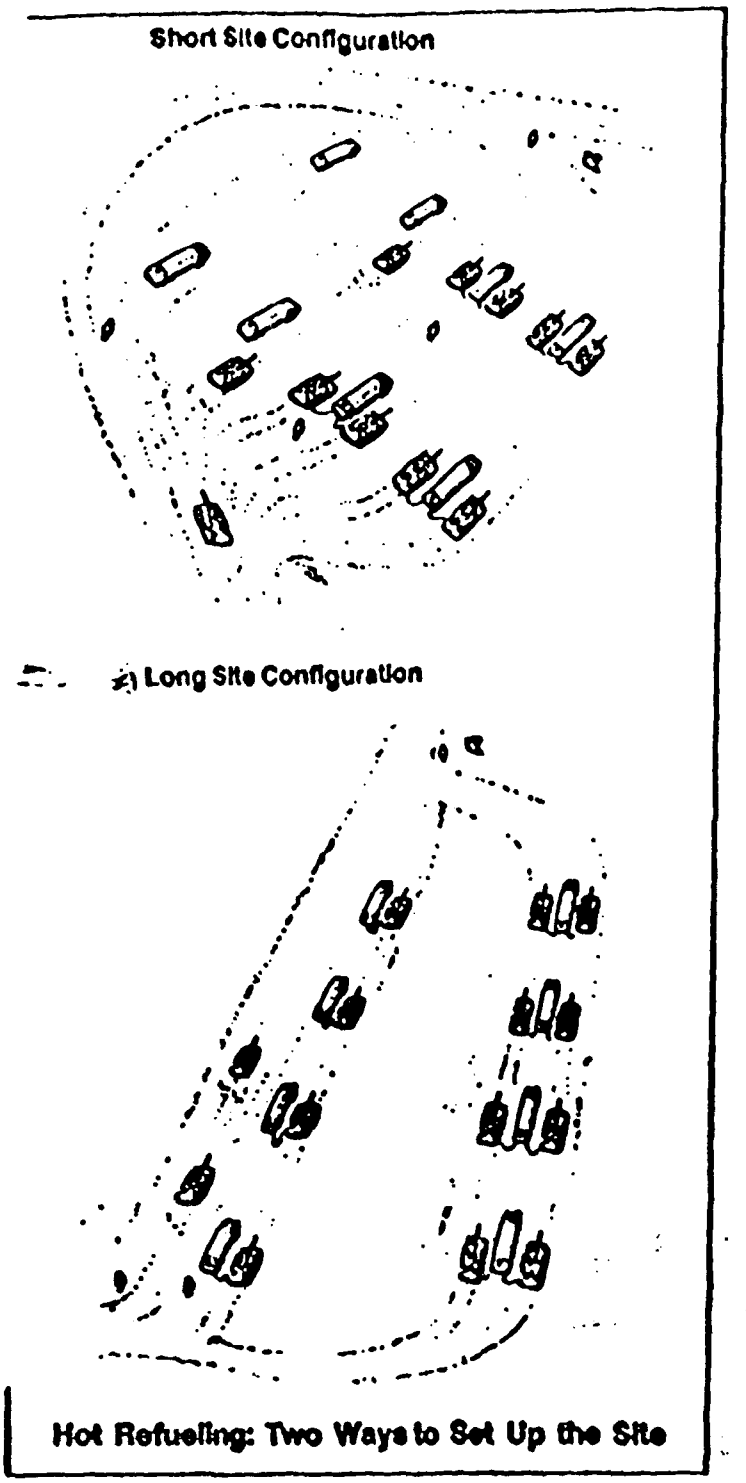


Figure 6. HOT Refueling Diagrams

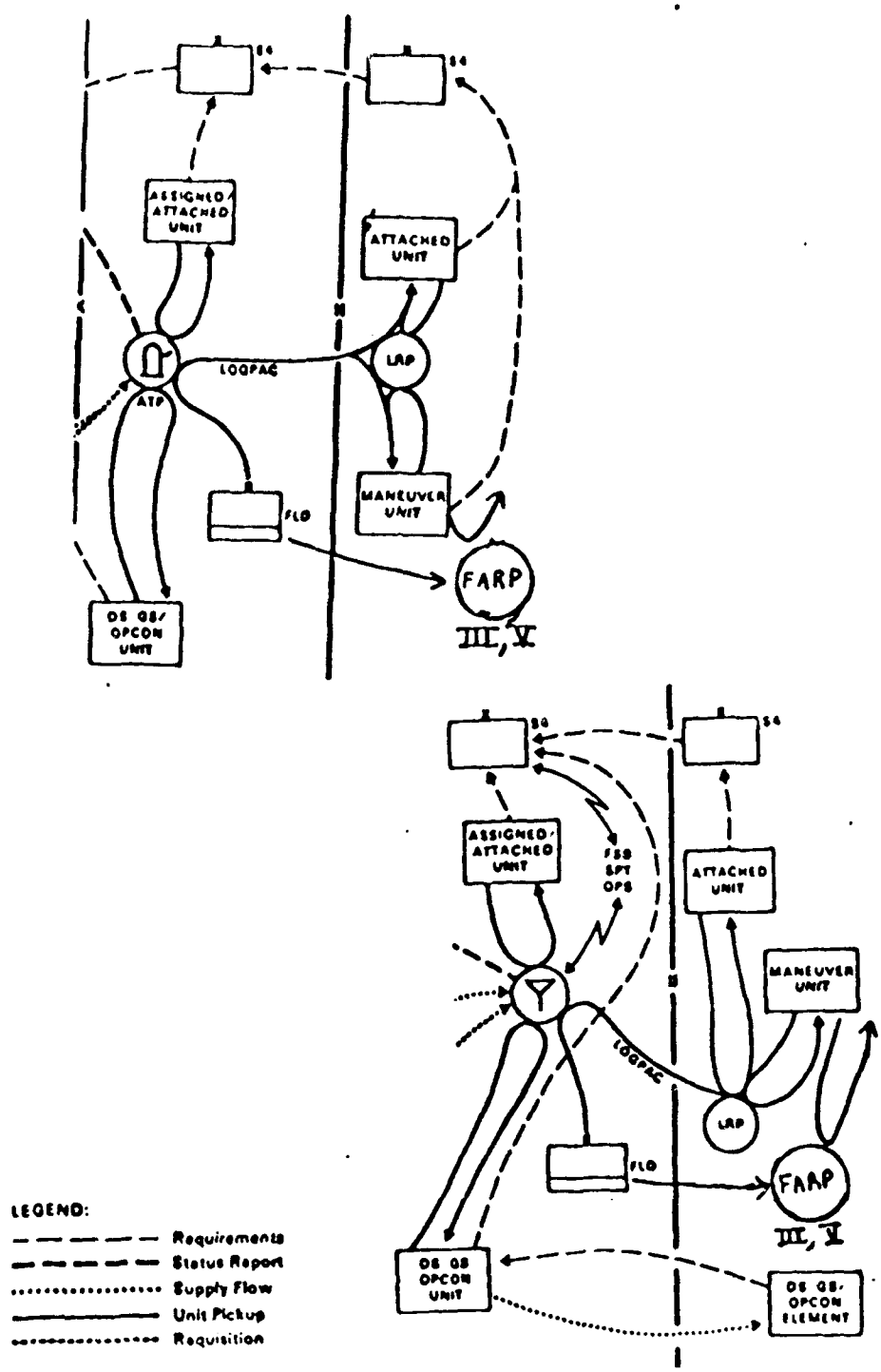


Figure 7. FARP Supply Diagram

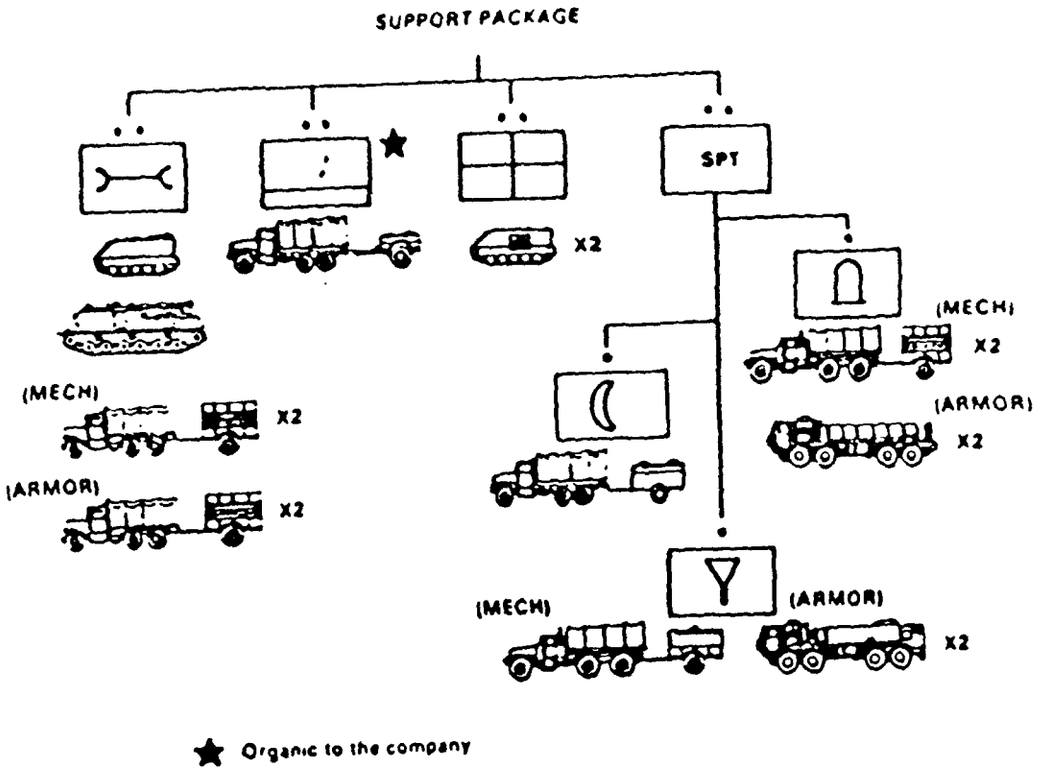


Figure 8. Support Package Diagram

BIBLIOGRAPHY

Standard Operating Procedures

3rd Infantry Division (Mechanized) Logistical Standard Operating Procedures, Wurzburg, Federal Republic of Germany, ROM Procedures

After Action Reviews

Center for Army Lessons Learned, Fort Leavenworth, Kansas. After-Action Review for two National Training Center Rotations

Government Publications

Anderson, Johnny M., A Comparative Study of the Best Method of Resupplying Conventional Class V in A Manuever Battalion. Fort Lee: US Army Logistics Center, 1981.

Fish, Major R., and Captain Wildy F. Berry, Forward Area fueling and Rearming Point. Fort Hood: Modern Army Selected Systems Test, Evaluation, and Review, 1975.

Fields, Major R., and Captain Otto A. von Oettingen, Armored Forward Area Rearm Vehicle (AFARV) Concept Evaluation Program Test. Fort Knox: US Armor and Engineer Board, 1982.

Garret, Jr., Paul F., Alan M. Poston, William B.Debellis, Harry J. Reed, and John M. Garthlinther, Human Engineering Laboratory Aviation Supply Class III/V Material (HELAVS III/V) Field Test. Aberdeen Proving Ground: US Army Human Engineering Laboratory, 1982.

Greer, Captain John, To Determine the Best Method of Resupplying conventional Class V (Ammunition) to a Heavy Division Units. Fort Lee: Defense Logistics Studies Information Exchange, 1982.

Poston, A.M. Forward Arming and Refueling Point Operations in a Chemical, Biological (CB) Environment. Maryland: Human Engineering Lab, 1985.

Poston, A.M., P.F. Garrett, and W.B. Debellis, Aviation Supply Class III/V Material. Maryland: Human Engineering Lab, April 1982.

Poston, A.M., P.F. Garrett, and W.B. Debellis. Aviation Supply Class III/V Material. Maryland: Human Engineering Lab, June 1982.

Reed, Harry J. and Richard N. Armstrong. An Evaluation of Forward Arming and Refueling Point (FARP) Operations During Fort Rucker Gunnery Exercises. Maryland: U.S. Army Human Engineering Laboratory, 1983.

Roeder, H.E. The Forward Area Resupply Point (FARP) of a German Anti-Tank Helicopter. Virginia: Army Training and Doctrine Command Liaison Office, 1980.

US Army. Combat system Rearm/Refuel in Battalions Study (CORSRIB). Fort Lee: U. S. Logistics Center, 1976.

US Army. FM 1-112, Tactics Techniques and Procedures for Attack Helicopter Battalion. Washington DC: Department of the Army, 1991.

US Army. FM 63-3 ,Corps Support Command. Washington DC: Department of the Army, 1992.

US Army. FM 54-30, Corps Support Groups. Wahington DC: Department of the Army, 1992.

US Army. FM 63-2, Division Support Command, Armored, Infantry, and Mechanized Infantry Divisions. Washington DC: Department of the Army, 1991.

US Army. FM 1-104, Forward Arming and Refueling Points. Washington DC: Department of the Army, 1985.

US Army. FM 63-20, Forward Support Battalion. Washington DC: Department of the Army, 1990.

US Army. FM 7-7J, The Mechanized Infantry Platoon and Squad (Bradley). Wahington DC: Department of the Army. 1986.

US Army. FM 9-6, Munitions Support in the Theater of Operations. Washington DC: Departmewnt of the Army, 1989.

US Army. FM 100-5 Field Service Regulation--Operation. Washington DC: Department of the Army, 1986.

US Army. Pamphlet 10-07245L Commanders' TOE Handbook--- Infantry Battalion (Mechanized). Washington DC: Department of the Army, 1989.

US Army. Pamphlet 10-63005 Commanders' TOE Handbook-- Forward Support Battalion. Washington DC: Department of the Army, 1989.

US Army. TM 9-2350-252-10-1,C/1, Operators Manual, Fighting Vehicle, Infantry M2. Washington DC: Department of the Army, 1986.2

US Army. TM 9-2350-255-10-1, c/6, Operators Manual, Tank, Combat, Full-Tracked: 105-MM Gun, M1. Washington DC: Department of the Army, 1981.

US Army. FM 10-71, C/2, Petroleum Tank Vehicle Operations. Washington DC: Department of the Army, 1990.

US Army. FM 101-10-1/2, Staff Officers' Field Manual. Washington DC: Department of the Army, 1987.

US Army. FM 71-2. The Tank and Mechanized Infantry Battalion Task Force. Washington DC: Department of the Army, 1988.

Studebaker, Wayne E., and James E. Christopher. Forward Area Refueling Equipment (FARE). Fort Belvior: U.S. Army Mobility Equipment Research and Development Center, 1972.

Wortham, Captain G. A Comparative Study of the Best Method of Refueling Combat Vehicles For Division '86 Organizational Structure. Fort Lee: Defense Logistics Studies Information Exchange, 1982.

York, Major Edmond R. Forward Area Refueling and Rearming Point (FARRP) Test Report. Fort Hood: Modern Army Selected Systems Test Evaluation and Review, 1973.

Books

Pagonis, William. Moving Mountains. Boston: Havard Business School Press, 1992.

Ross, William and Charles Romanus. The Quartermaster Corps: Operations in the War Agianst Germany. Washington D.C.: U.S. Government Printing Office, 1965.

Articles

Allgood, Colonel C., and Colonel George Merklinger, "What His FARRP, Man!" US Army Aviation Digest. (July 1975): 8-10.

Dempsey, Major M., and Captain Alfred C. Tanner, "Hot Refuel: Part of the Agility Equation," Armor, May-June 1989.

House, Captain John, "Rearming and Refueling," Field Artillery Journal, Volumn 51, 4, (July-August 1983): 46-51.

Kral, Anthony H., "Sustaining Patton's Pursuit," Army Logistician (July-August 1992): 27-30.

Pagonis, William G., and Micheal D Krause, "Theater Logistics in the Gulf," Army Logistician (July-August 1992): 2-9.

Predmore, Captain Kieth, "The Upload Exercise," Field Artillery Journal. May-June 1976.

Rutherford III, Col. Wilson, and MAJ William Brame. "Brute Force Logistics," Military Review (March 1993): 61-69.

Sayre, Captain Gordon, "Formula for a FARRP," US Army Aviation Digest (April 1978): 1-6.

Studebaker, Wayne E. and James E. Christopher. Forward Area Refueling Equipment (FARE). Virginia: U.S. Army Mobility Equipment Research and Development Center, 1972.

Unpublished Dissertations, Theses, and Papers

Roberts, Frank N. "Logistics in Desert Operations: Lessons Learned from the National Training Center." Master of Military Arts and Science. Thesis, US Army Command and General Staff College, 1974.

Tucker, Christopher, "Sustaining the Light-Heavy Brigade." Master of Military Art and Science. Thesis, US Army Command and General Staff College, 1991.

INITIAL DISTRIBUTION LIST

1. Cobined Arms Research Library
   U.S. Army Command and General Staff College
   Fort Leavenworth, KS 66027-6900

2. Defense Technical Information Center
   Cameron Station
   Alexandria, VA 22314

3. LTC Dennis Barba
   Department of Supply and Resource Operations
   USACGSC
   Fort Leavenworth, KS 66027-6900

4. LTC Mary Goodwin
   Department of Supply and Resource Operations
   USACGSC
   Fort Leavenworth, KS 66027-6900

5. James C. McNaughton, PhD
   Defense Language Institute
   Foriegn Language Center
   Attn: ATFL-MH
   Presidio of Monterey, CA 93944-5006

6. Commander
   Combat Service Support Command
   Ft. Lee, VA 23801

8. Commander
   U.S. Army Infantry Center and School
   Ft Benning, GA